United States
Department of
Agriculture

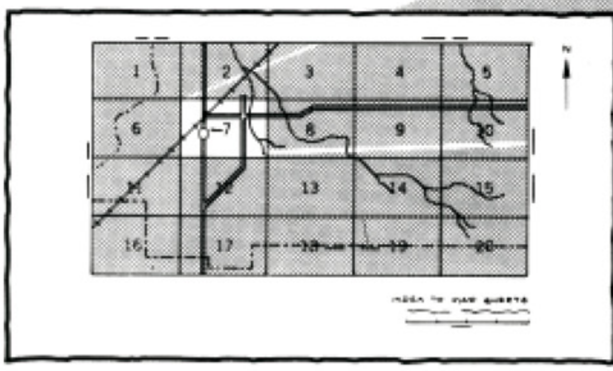
Soil
Conservation
Service

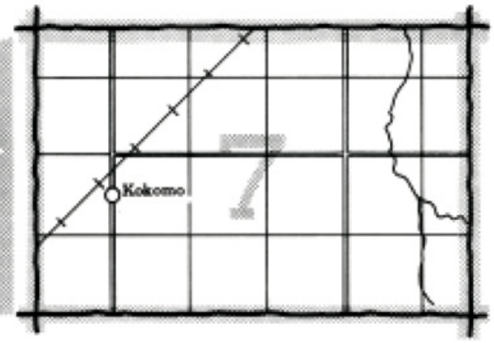
In cooperation with
Purdue University
Agricultural Experiment
Station and
Indiana Department of
Natural Resources
Soil and Water
Conservation Committee

Soil Survey of DeKalb County Indiana

HOW TO USE

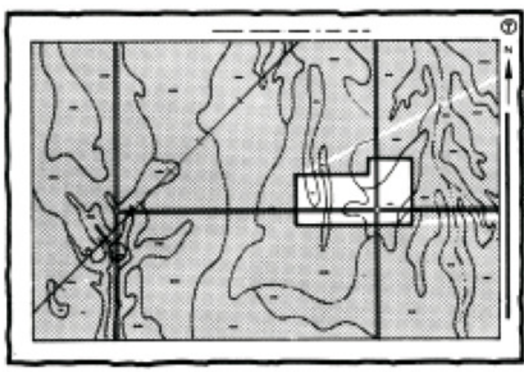
1. Locate your area of interest on the "Index to Map Sheets"

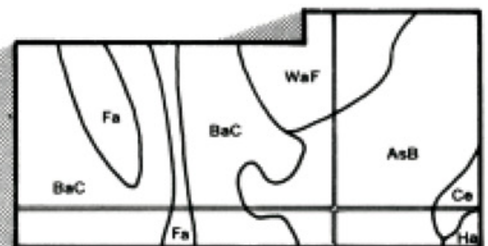




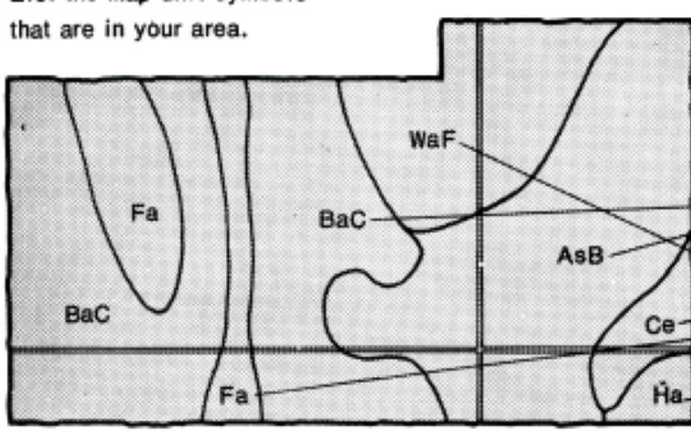
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area.



Symbols

AsB
BaC
Ce
Fa
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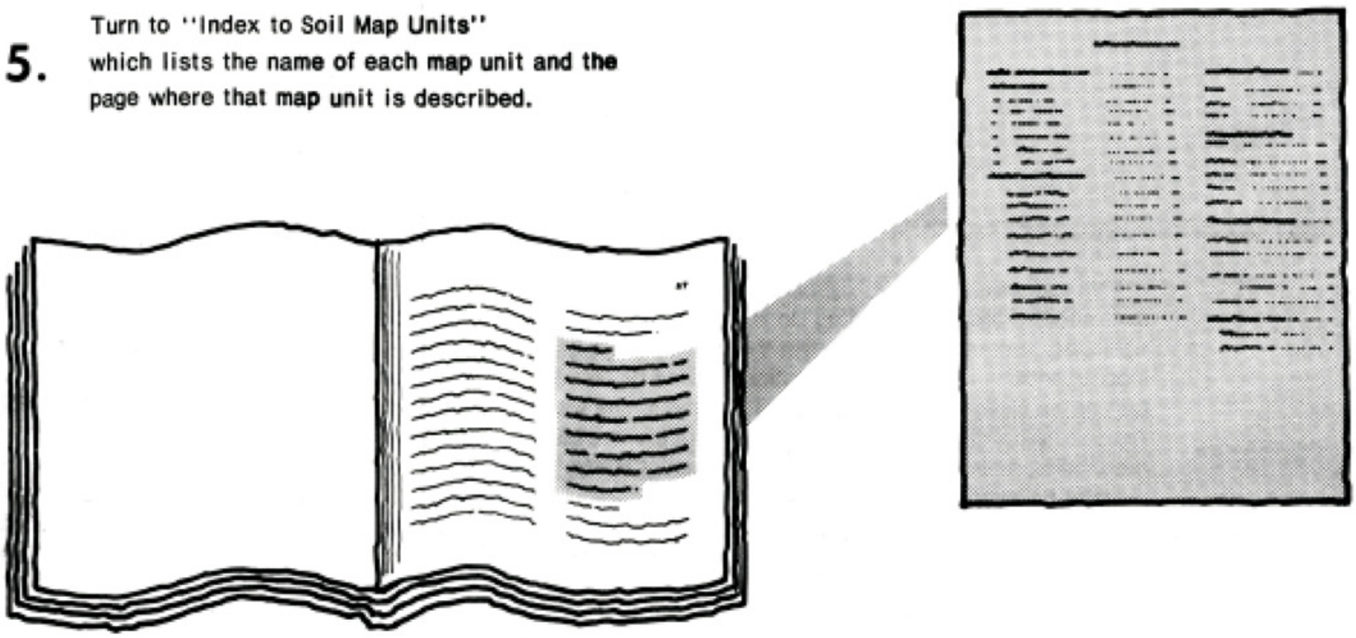
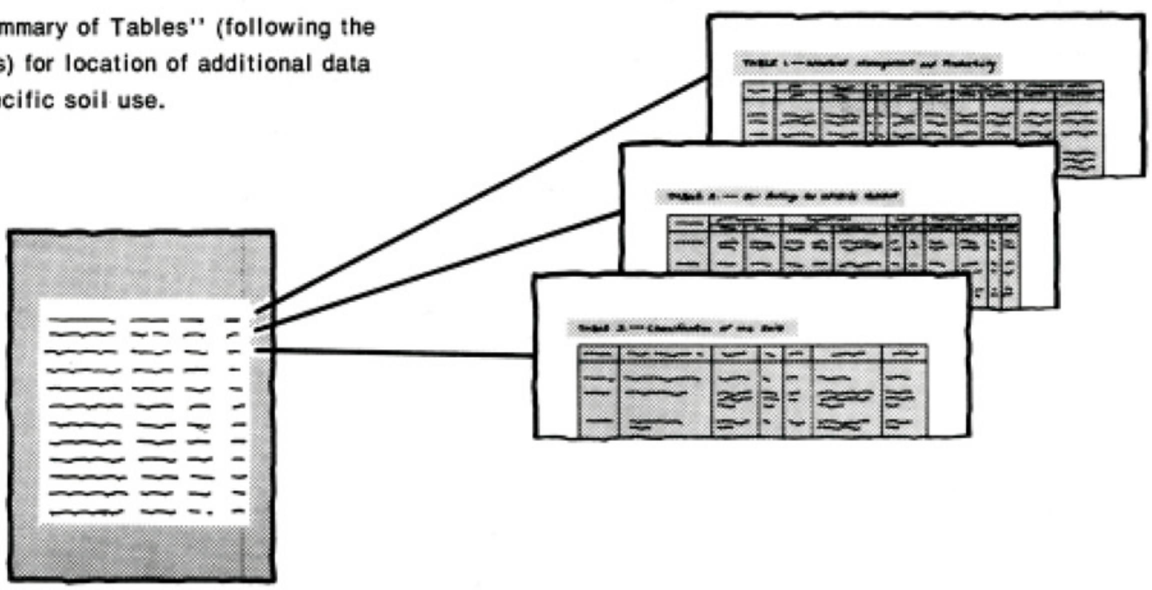
WaF

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service, Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the DeKalb County Soil and Water Conservation District. Financial assistance was made available by the Soil and Water Conservation Committee, DeKalb County Commissioners, and the Indiana Department of Natural Resources. Major fieldwork was performed in the period 1975-1979. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Typical view of soils in the Strawn-Conover map unit used for crops, pasture, and woodland.

contents

soil series

Issued August 1982

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foreword

This soil survey contains information that can be used in land-planning programs in DeKalb County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

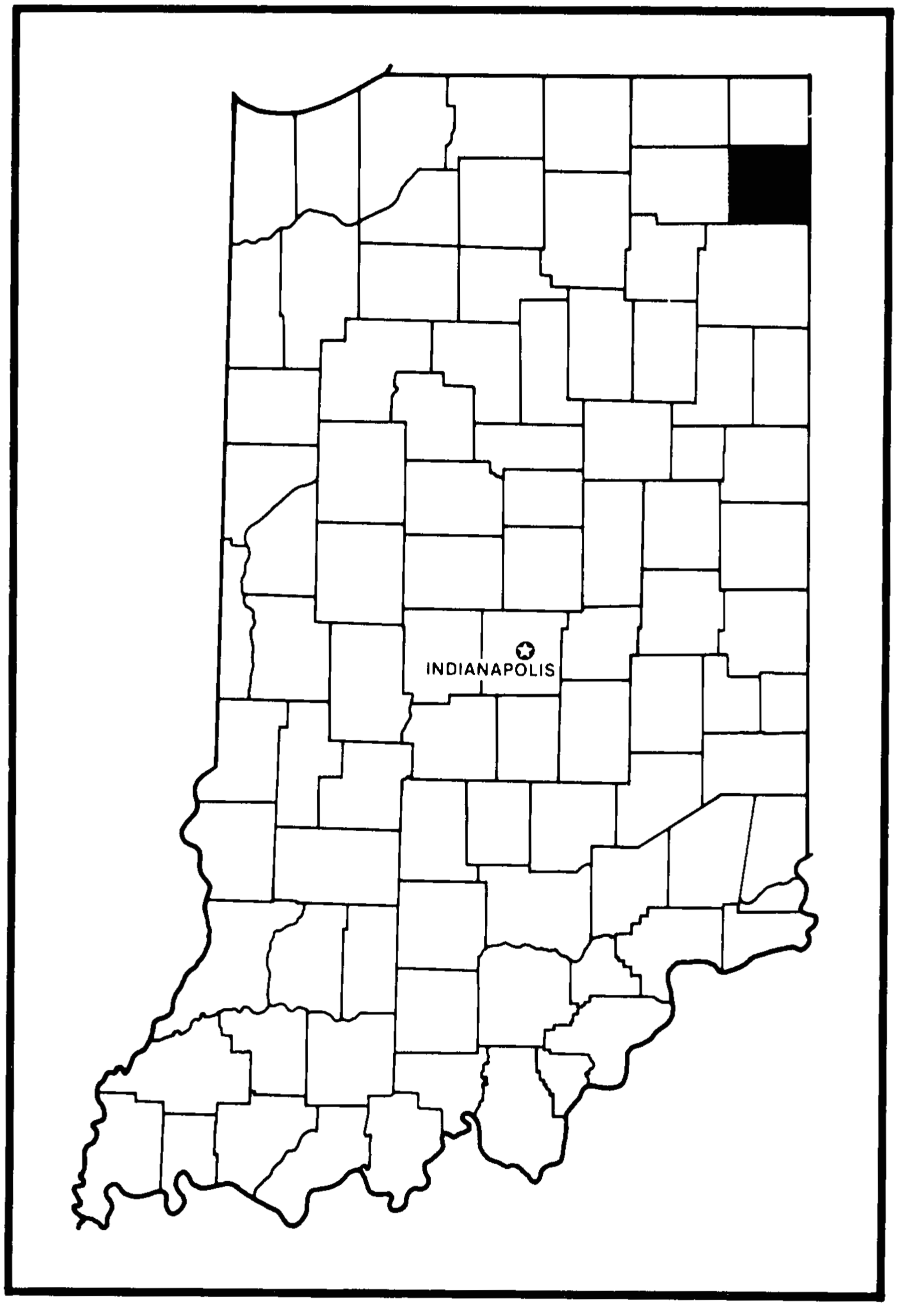
This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L. Eddleman

Robert L. Eddleman
State Conservationist
Soil Conservation Service



Location of DeKalb County in Indiana.

soil survey of
DeKalb County, Indiana

Survey by Earnest L. Jensen, Soil Conservation Service

Fieldwork by Earnest L. Jensen, Soil Conservation Service
Susan E. Fischer and David K. Lefforge
Indiana Department of Natural Resources, Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Purdue University Agricultural Experiment Station and
Indiana Department of Natural Resources, Soil and Water Conservation Committee

DeKalb County is in the northeastern part of Indiana adjacent to the Ohio state line. It is roughly square in outline and has an area of 366 square miles, or 234,240 acres. Auburn is the county seat and the largest town in the county.

The main farm enterprises are the growing of cash grain crops and the raising of livestock. Corn, soybeans, and wheat are the main crops in DeKalb County. Much of the county has poor natural drainage and needs artificial drainage.

The population of DeKalb County was about 33,600 in 1980 and about 30,800 in 1970. Recently, urban development has been extensive in Auburn. Construction of housing has greatly increased in rural areas throughout the southern half of the county. A large number of residents in DeKalb County are employed in industry in the cities of Auburn, Butler, and Garrett and many are employed in Fort Wayne, which is in nearby Allen County.

general nature of the survey area

This section gives general information concerning DeKalb County. It discusses relief and drainage, water supply, and climate.

General features that affect the use of the soil in DeKalb County are briefly described in the following paragraphs.

relief and drainage

DeKalb County is generally flat to gently rolling. Relief is low with abrupt changes. The northwestern corner of the county is generally more rolling than the rest, and the central and southeastern part is more nearly level. The county is dissected by Cedar Creek, Fish Creek, Little Cedar Creek, and the St. Joseph River.

The highest elevation in DeKalb County is about 2 miles west of Fairfield. It is about 1,060 feet above sea level. The lowest elevation is in the extreme southeast corner of DeKalb County, on the Ohio state line. It is 764 feet above sea level.

Cedar Creek flows southward through the central part of DeKalb County. Fish Creek drains the northeastern part of the county. The St. Joseph River drains the southeastern part, and Little Cedar Creek drains the western part of the county.

There are 11 lakes in the county. They range in size from Indian Lake (46 acres) to Depew Lake (2 acres). Numerous small ponds are throughout the county.

water supply

Wells are the main source of water in DeKalb County. Many wells are used to supply water to cities and towns. Most rural farmsteads have wells that extend into the glacial till.

The supply of ground water is sufficient in most areas of the county. The principal sources of ground water are

sand and gravel deposits deep within the glacial till and sand and gravel deposits along the major tributaries in the county.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Waterloo, Indiana, in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 18 degrees. The lowest temperature on record, which occurred at Waterloo on February 17, 1973, is -21 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 102 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 34 inches. Of this, 20 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 5.40 inches at Waterloo on September 14, 1972. Thunderstorms occur on about 40 days each year, and most occur in summer.

Average seasonal snowfall is 27 inches. The greatest snow depth at any one time during the period of record was 18 inches. On an average of 20 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration and cause damage in a variable pattern.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; and the kinds of native plants or crops. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their suitability for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the suitability of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil suitability ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, woodland, urban uses,* and *recreation areas*. Cultivated crops and pasture plants are those grown extensively in the survey area. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

The names, descriptions, and delineations of soils on the general soils map of this county do not always agree or join fully with those of adjoining counties published at an earlier date. This difference is due to changes in concepts of soil series in the application of the soil classification system. Other differences are brought about by a predominance of soils in map units made up of two or three series. Still other differences may be caused by the range in slope allowed within the map unit of adjoining surveys. In this county or in adjacent counties a map unit is sometimes too small to be delineated.

soil descriptions

1. Blount-Pewamo-Glynwood

Deep, moderately well drained to very poorly drained, nearly level and gently sloping, silty, clayey, and loamy soils; on till plains and moraines

This map unit is on till plains and moraines. It is characterized by a very gradual swale-and-swell topography and by an occasional area that has frequent changes in slope. Slopes range from 0 to 6 percent.

This map unit covers about 55 percent of the survey area. It is about 53 percent Blount soils, 24 percent Pewamo soils, and 7 percent Glynwood soils. The rest is minor soils (fig. 1).

Blount soils are nearly level and somewhat poorly drained. They are on the higher lying broad flats and slight rises. They have a surface layer of dark grayish brown silt loam. The subsoil is grayish brown, mottled clay loam in the upper part and dark yellowish brown, mottled clay and silty clay loam in the lower part.

Pewamo soils are nearly level and very poorly drained. They are in depressional areas. They have a surface layer of black silty clay and a subsoil of dark gray and gray, mottled silty clay.

Glynwood soils are gently sloping and moderately well drained. They are on the higher lying, convex side slopes. They have a surface layer of brown loam and a subsoil of dark yellowish brown, mottled clay.

The minor soils in this map unit are in the Morley, Rawson, Rensselaer, and Houghton series. The well drained Morley soils are in moderately sloping to moderately steep areas; the moderately well drained or well drained, less clayey Rawson soils are on low ridges and knolls; the very poorly drained, less clayey Rensselaer soils are along old drainageways; and the very poorly drained, organic Houghton soils are in depressions.

About 90 percent of the acreage of this unit has been cleared. It is well suited to cultivated crops. Most areas are used for corn, soybeans, and small grains. Wetness and erosion are the main management concerns.

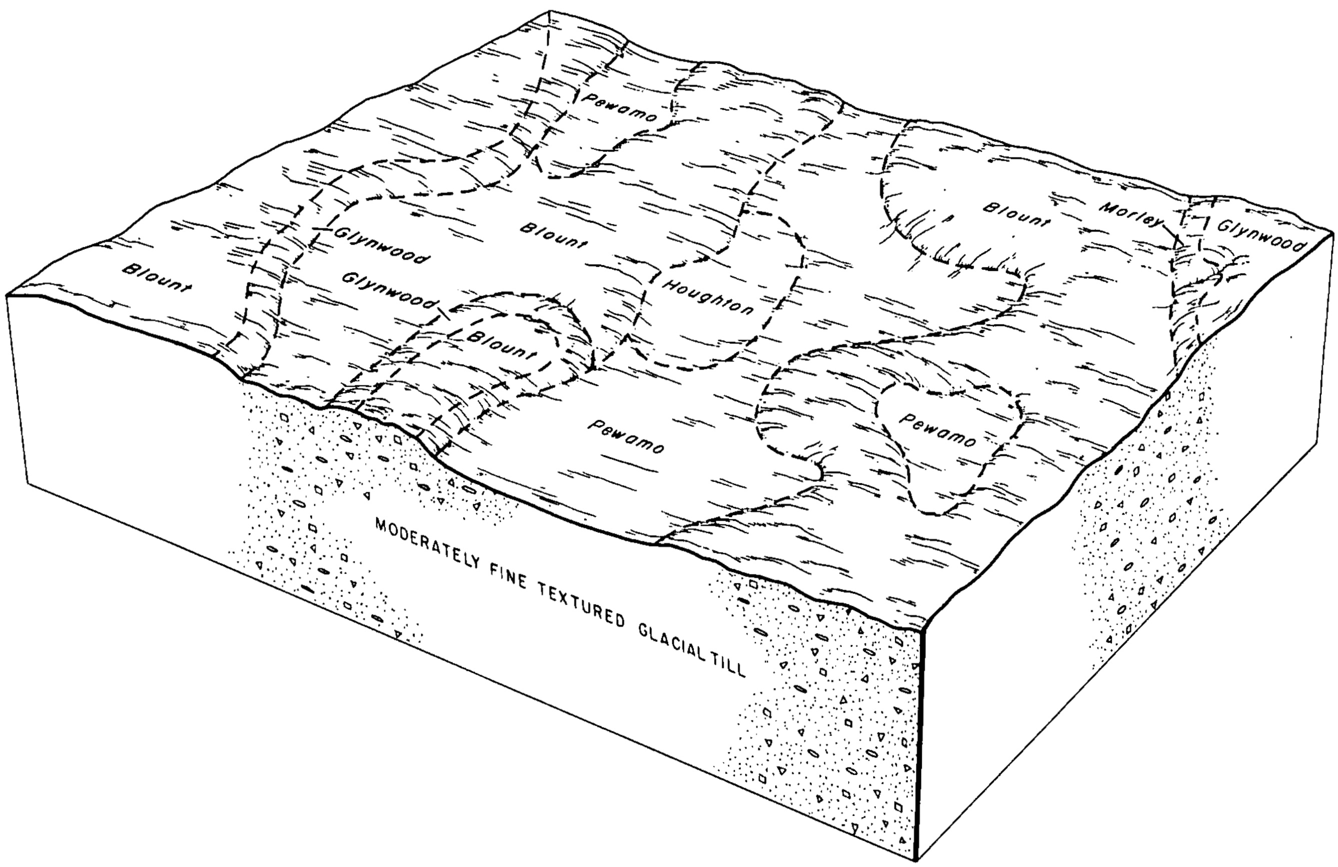


Figure 1.—Typical pattern of soils and underlying material in the Blount-Pewamo-Glynwood map unit.

Some areas of these soils are used for pasture. These soils are well suited to this use. Overgrazing and grazing when these soils are wet are major concerns of management that accelerate erosion, surface compaction, and poor tilth.

These soils are suited to trees. Seedling mortality and windthrow losses are concerns of management. Where the soils are wet, trees do not grow as rapidly and the use of equipment is limited.

These soils are poorly suited to sanitary facilities and building sites. Wetness and slow permeability are the main limitations.

2. Glynwood-Pewamo-Morley

Deep, moderately well drained, very poorly drained, and well drained, nearly level to steep, loamy, clayey, and silty soils; on till plains and moraines

This map unit is on till plains and moraines. In some places it is dissected by drainageways. Slopes range from 0 to 30 percent.

This map unit covers about 32 percent of the survey area. It is about 33 percent Glynwood soils, 18 percent Pewamo soils, and 14 percent Morley soils. The rest is minor soils.

Glynwood soils are gently sloping and moderately well drained. They are on the higher lying, convex side slopes. They have a surface layer of brown loam and a subsoil of dark yellowish brown, mottled clay.

Pewamo soils are nearly level and very poorly drained. They are in depressional areas. They have a surface layer of black silty clay and a subsoil of dark gray and gray, mottled silty clay.

Morley soils are steep and well drained. They are in the more dissected areas. They have a surface layer of dark grayish brown silt loam or brown silty clay loam. The subsoil is dark brown silty clay loam in the upper part and brown and dark brown clay in the lower part.

The minor soils in this unit are in the Blount, Rawson, Rensselaer, and Houghton series. The somewhat poorly drained Blount soils are on the broad flats and slight rises; the moderately well drained or well drained, less clayey Rawson soils are on low ridges and knolls; the very poorly drained, less clayey Rensselaer soils are along old drainageways; and the very poorly drained, organic Houghton soils are in depressions.

About 85 percent of the acreage of this unit has been cleared. It is well suited to cultivated crops. Most areas are being used for corn, soybeans, and small grains. Wetness, erosion, and slope are the main management concerns.

Some areas of these soils are used for pasture. These soils are well suited to this use. Overgrazing and grazing when these soils are wet and in steeper areas are the major concerns of management that accelerate erosion, surface compaction, and poor tilth.

These soils are well suited to trees. Seedling mortality and windthrow losses are concerns of management. Where the soils are wet, trees do not grow as rapidly and the use of equipment is limited.

These soils are poorly suited to sanitary facilities and building sites. The main limitation is slow permeability. Other limitations are wetness on the Pewamo and Glynwood soils and slope on the Morley soils.

3. Strawn-Conover

Deep, well drained and somewhat poorly drained, nearly level to strongly sloping, loamy soils; on moraines

This map unit consists of rolling moraines and sharp ridges along drainageways. In some places it is dissected by drainageways. Slopes range from 0 to 18 percent.

This map unit covers about 6 percent of the survey area. It is about 52 percent Strawn soils and 10 percent Conover soils. The rest is minor soils.

Strawn soils are in gently sloping to strongly sloping, dissected areas and on side slopes along streams. They have a surface layer of brown loam and a subsoil of dark yellowish brown loam and clay loam.

Conover soils are in concave areas of moraines. They have a surface layer of very dark grayish brown loam. The subsoil is dark grayish brown clay loam and loam in the upper part and dark yellowish brown, mottled loam in the lower part.

The minor soils in this map unit are in the Boyer, Hillsdale, Rensselaer, and Houghton series. The well drained, less clayey Boyer soils are on outwash terraces; the well drained, less clayey Hillsdale soils are on upland moraines that have more sand throughout; the very poorly drained Rensselaer soils are along old drainageways; and the very poorly drained, organic Houghton soils are in depressions.

About 85 percent of the acreage of this unit has been cleared. It is well suited to most cultivated crops. Most areas are used for corn, soybeans, and small grains.

Some areas of the steeper soils are used for pasture and hay. Most of the soils in this unit are well suited to pasture. Slope and wetness in concave areas are the main limitations. Overgrazing and grazing when the soils are wet are major concerns of management that accelerate erosion.

These soils are well suited to trees. Erosion hazard, equipment limitation, and seedling mortality are concerns in managing the strongly sloping Strawn soils.

Most of the soils in this unit are suited to building sites and sanitary facilities. The strongly sloping Strawn soils and the somewhat poorly drained Conover soils are severely limited for septic tank absorption fields.

4. Boyer-Landes-Sebewa

Deep, well drained, moderately well drained, and very poorly drained, nearly level to moderately sloping, loamy soils underlain by sand and gravel; on terraces, outwash plains, moraines, and flood plains

This map unit is on terraces, outwash plains, moraines, and flood plains. It consists of swales, flood plains, and knolls and breaks along streams. Slopes range from 0 to 12 percent.

This map unit covers about 5 percent of the survey area. About 34 percent of the unit is Boyer soils, 23 percent is Landes soils, and 16 percent is Sebewa soils. The rest is minor soils.

Boyer soils are well drained, nearly level to moderately sloping, and moderately deep over sand and gravel. They have a surface layer of dark grayish brown sandy loam and a subsoil of dark yellowish brown sandy loam and reddish brown gravelly sandy loam.

Landes soils are moderately well drained and well drained and nearly level. They are on flood plains. They have a surface layer of very dark grayish brown fine sandy loam and a subsoil of brown fine sandy loam.

Sebewa soils are very poorly drained, nearly level, and moderately deep over sand and gravel. They are in depressional areas, in swales, and along drainageways. They have a surface layer of black sandy loam and a subsoil of gray, mottled sandy clay loam and loamy sand.

The minor soils in this map unit are in the Eel, Ormas, and Oshtemo series. The moderately well drained, more clayey Eel soils are on flood plains, and the well drained Ormas and Oshtemo soils are deeper to the underlying material and are on outwash plains and terraces.

Most areas of the soils in this unit are used for corn, soybeans, and small grains. These soils are suited to this use. Droughtiness, flooding, and ponding are the main hazards. Late planting or replanting may be necessary on the Landes soils. Some areas of this unit are used for mining sand and gravel.

Some areas of these soils are used for pasture. They are well suited to this use. Droughtiness and wetness are the major concerns of management.

These soils are suited to trees. Droughtiness and wetness are the main management concerns.

These soils are poorly suited to sanitary facilities and building sites. Ground-water contamination is a possibility where they are used for septic tank absorption fields. Where these soils are used for urban development, flooding of the Landes soils and ponding of the Sebewa soils are severe hazards.

5. Boyer-Sebewa-Oshtemo

Deep, well drained and very poorly drained, nearly level to moderately sloping, loamy soils underlain by sand and gravel; on terraces, outwash plains, and moraines

This map unit is on terraces, outwash plains, and moraines. It consists of depressions, swales, and knolls and breaks along streams. Slopes range from 0 to 12 percent.

This map unit covers about 2 percent of the survey area. About 38 percent of the unit is Boyer soils, 32 percent is Sebewa soils, and 19 percent is Oshtemo soils. The rest is minor soils.

Boyer soils are well drained, nearly level to moderately sloping, and moderately deep over sand and gravel. They have a surface layer of dark grayish brown sandy loam and a subsoil of dark yellowish brown sandy loam and reddish brown gravelly sandy loam.

Sebewa soils are very poorly drained, nearly level, and moderately deep over sand and gravel. They are in depressional areas, in swales, and along drainageways. They have a surface layer of black sandy loam and a subsoil of gray, mottled sandy clay loam and loamy sand.

Oshtemo soils are well drained and nearly level to moderately sloping. They have a surface layer of brown sandy loam and a subsoil of dark yellowish brown sandy loam, gravelly sandy loam, and fine sandy loam.

The minor soils in this map unit are in the Rensselaer and Houghton series. The very poorly drained, less sandy Rensselaer soils are along old drainageways, and the organic Houghton soils are in depressional areas.

Most areas of soils in this unit are used for corn, soybeans, and small grains. They are suited to this use. Droughtiness is the main hazard. Some areas are used for mining sand and gravel.

Some areas of these soils are used for pasture. They are well suited to this use. Droughtiness is the major concern of management.

These soils are suited to trees. Droughtiness and wetness are the main management concerns.

These soils are poorly suited to sanitary facilities and building sites. Ground-water contamination is a possibility where they are used for septic tank absorption fields. Ponding is a hazard in the lower areas.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Morley silt loam, 6 to 12 percent slopes, eroded, is one of several phases in the Morley series.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

BaA—Blount silt loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is in large, broad flat areas of till plains. Areas are irregular in shape and range from 2 to 40 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 26 inches thick. The upper part is grayish brown and dark yellowish brown, mottled, firm clay loam and clay, and the lower part is dark yellowish brown, mottled, firm silty clay loam. The underlying material to a depth of 60 inches or more is brown silty clay loam. In places as much as 14 inches of loamy sand is on the surface. In other places this soil has less clay in the subsoil and underlying material and has clay loam stratified with sandy loam in the underlying material. A few small areas are underlain by sand or pockets of sand and gravelly sand. In a few areas, cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are small areas of Blount soils that have slopes of 2 to 4 percent and areas of moderately well drained Glynwood soils on knolls. Also included are small areas of Haskins soils, which have more sand and less clay in the surface layer and upper part of the subsoil and are higher on the landscape than the Blount soil. Small areas of very poorly drained Pewamo and Bono soils are in depressions, and small areas of steep soils are along major tributaries. These inclusions make up about 2 to 10 percent of this unit.

The available water capacity of this Blount soil is moderate, and permeability is slow. Surface runoff is slow, and the organic matter content is moderate. The water table is at a depth of 1 foot to 3 feet during the winter and spring. Tilling this soil when it is too wet causes large clods to form, which makes seedbed preparation difficult.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are in woodland.

This soil is well suited to corn, soybeans, and small grains. Wetness is the main limitation. Artificial drainage is necessary to attain consistently high yields. There are many open ditches and subsurface drains in areas of this soil. Conservation tillage that leaves all or part of the

crop residue on the surface helps maintain good tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. Drainage is generally beneficial. Deep-rooted crops are not as well suited to this soil as shallow-rooted crops. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and decreased plant density and hardiness. Proper stocking, pasture rotation, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

This soil is suited to trees. Seedling mortality and windthrow losses are major management concerns. The use of special site preparation, such as bedding, is needed in some areas. Harvesting methods should be used that do not leave trees standing alone or widely spaced.

The use of this soil for building sites is severely limited by wetness. The installation of subsurface drains can lower the water table. Foundations, footings, and basement walls should be strengthened and backfilled with a coarser material, which helps prevent structural damage from shrinking and swelling. The use of this soil for local roads and streets is severely limited by low strength and frost action. Providing adequate drainage along roads reduces possible damage from frost action. The base material needs to be replaced or strengthened with a more suitable material to support vehicular traffic.

The use of this soil for septic tank absorption fields is severely limited by wetness and slow permeability. Filling or mounding with a more suitable fill material to raise the absorption field can reduce the permeability problem. Drains around the outer edges of the absorption field remove excess water.

This soil is in capability subclass IIw and woodland suitability subclass 3c.

BaB2—Blount silt loam, 1 to 4 percent slopes, eroded. This gently undulating, deep, somewhat poorly drained soil is on till plains and moraines. Areas are generally broad and irregular in shape. They range from 5 to 200 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is about 90 percent dark grayish brown silt loam and 10 percent grayish brown silty clay loam and is about 8 inches thick. The subsoil is about 14 inches thick. The upper part is grayish brown, mottled, firm silty clay loam, and the lower part is dark yellowish brown, mottled, firm silty clay. The underlying material to a depth of 60 inches or more is brown clay loam. In some areas there is as much as 14 inches of loamy sand on the surface and less clay in the subsoil or clay loam stratified with sandy loam in the underlying material. A few small areas are underlain by sand or pockets of sand and gravelly sand. In a few areas, cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are small areas of well drained Morley soils on the higher knolls. Also included are areas of a well drained, steep soil along major tributaries. The very poorly drained Pewamo and Bono soils are in depressional areas. The moderately well drained Glynwood soils are higher on the landscape than the Blount soil and are less gray in the upper part of the subsoil. Also included are small areas of moderately well drained or well drained Rawson soils, which have more sand and less clay in the surface layer and upper part of the subsoil and are on higher positions on the landscape. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Blount soil is moderate, and permeability is slow. Surface runoff is medium, and the organic matter content is moderate. The water table is at a depth of 1 foot to 3 feet during the winter and spring. Tilling this soil when it is too wet causes clods to form, which makes seedbed preparation difficult.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are in woodland.

This soil is well suited to corn, soybeans, and small grains. Erosion is a hazard on this soil (fig. 2). Crop rotation, grassed waterways, or grade stabilization structures help prevent erosion. Conservation tillage that leaves all or part of the crop residue on the surface and cover crops help to control erosion and improve and maintain tilth and the organic matter content of the soil. Wetness limits the use of this soil. Open ditches and subsurface drains are needed to lower the water table.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet may result in surface compaction, reduced plant density, excessive runoff, and poor tilth. Proper stocking, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality and windthrow losses are major management concerns. Special site preparation, such as bedding, is needed in some areas. Harvesting methods should be used that do not leave trees standing alone or widely spaced.

The use of this soil for building sites is severely limited by wetness. The installation of subsurface drains can lower the water table. Foundations, footings, and basement walls should be strengthened and backfilled with coarser material to help prevent structural damage from shrinking and swelling of the soil. Existing vegetation should be disturbed as little as possible during construction, but those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is severely limited by low strength and frost action. Providing adequate drainage along roads reduces possible damage from frost action. The base material

Figure 2.—Soil material washed from an unprotected area of Blount silt loam, 1 to 4 percent slopes, eroded.

needs to be replaced or strengthened with a more suitable material to support vehicular traffic.

The use of this soil for septic tank absorption fields is severely limited by wetness and slow permeability. Filling or mounding with a more suitable fill material to raise the absorption field can reduce the permeability problem. Drainage around the outer edges of the absorption field removes excess water.

This soil is in capability subclass IIe and woodland suitability subclass 3c.

Bn—Bono silty clay. This nearly level, deep, very poorly drained soil is on glacial lakebeds. It is in depressions and is subject to frequent ponding for brief periods. Areas are irregular in shape and range from 3 to 85 acres.

In a typical profile, the surface layer is very dark gray silty clay about 10 inches thick. The subsoil is about 48 inches thick. The upper part is gray and dark gray, mottled, firm silty clay, and the lower part is dark gray, mottled, firm clay and silty clay loam. The underlying material to a depth of 60 inches or more is dark gray, mottled silty clay loam. In places there is less clay in the subsoil. In other places there is less than 10 inches of dark surface soil. Some places have up to 17 inches of overwash, and other places have up to 14 inches of muck.

Included with this soil in mapping are small areas of mucky Houghton and Martisco soils that occupy the slightly lower positions, small areas underlain by glacial till or muck, and small areas of less clayey Rensselaer soils higher on the landscape than the Bono soil. These inclusions make up about 2 to 10 percent of the unit.

The available water capacity of this Bono soil is moderate, and permeability is slow. Surface runoff is slow to ponded, and the organic matter content is high. The water table is at or above the surface during the winter and spring. The surface layer becomes cloddy and hard to work if tilled when wet.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and a few areas are in woodland.

Areas of this soil that are adequately drained are suited to corn, soybeans, and small grains. Wetness is the main limitation of this soil. Excess water can be removed by open ditches, subsurface drains, and surface drains. Conservation tillage that leaves all or part of the crop residue on the surface improves and helps maintain tilth.

This soil is well suited to grasses and legumes for hay and pasture. Drainage is necessary to obtain normal yields of forage and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, which result in reduced plant density and hardiness and reduced yields. Proper stocking, timely deferment of grazing, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

This soil is suited to trees. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Harvesting of trees can be delayed to extremely dry seasons or when the ground is frozen. Species of trees that are water tolerant should be favored in stands. Seedlings survive and grow when competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited by ponding. It is generally unsuitable for this use. The use of this soil for roads is severely limited by ponding, low strength, and frost action. It may be necessary to replace layers of the soil that have a high shrink-swell potential and low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts will protect them from ponding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 3w.

BoB—Boyer sandy loam, 0 to 6 percent slopes. This nearly level and gently sloping, well drained soil is moderately deep over sand and gravel. It is on outwash plains, terraces, and moraines. Areas are irregular in shape and range from 2 to 100 acres.

In a typical profile, the surface layer is dark grayish brown sandy loam about 10 inches thick. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches or more is pale brown gravelly coarse sand. Some areas do not have gravel in the subsoil and underlying material. Some areas have a thicker surface layer and subsoil. In some places there is more clay in the surface layer and subsoil. Also in places there is glacial till within a depth of 60 inches. In a few areas, cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small depressional areas of very poorly drained Sebewa soils. Also included are small areas of moderately well drained or well drained Rawson soils which have more clay and less sand in the surface layer and subsoil and are on higher positions on the landscape than the Boyer soil. Also included are small areas of Ormas soils that have more sand in the surface and subsurface layers. Also included are a few areas of Metea soils that are sandier in the surface and subsurface layers and are higher on the landscape. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Boyer soil is low. Permeability is moderately rapid in the surface layer and subsoil and very rapid in the underlying material. Surface runoff is slow, and the organic matter content is moderate. The surface layer is friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is suited to corn, soybeans, and small grains. Droughtiness is the main hazard, particularly for shallow-rooted crops. Other hazards are soil blowing and erosion. When feasible, irrigation increases yields. Conservation tillage that leaves all or part of the crop residue on the surface and cover crops (fig. 3) help to control erosion and to maintain tilth and the organic matter content and moisture content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. The use of this soil for this purpose is effective in controlling wind and water erosion. Droughtiness is a hazard, especially for shallow-rooted grasses. Proper stocking, pasture rotation, timely deferment of grazing, and favoring deep-rooted species reduce surface compaction and maintain good tilth and plant density.

This soil is suited to trees. Droughtiness may be a management concern. Species of trees tolerant to low moisture conditions should be favored in stands.

The soil is suited to building sites and local roads and streets. The use of this soil is severely limited for septic tank absorption fields by poor filtering qualities. This soil readily absorbs the effluent from the septic tank absorption field, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground water supplies.

This soil is in capability subclass IIIs and woodland suitability subclass 3o.

BoC—Boyer sandy loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is moderately deep over sand and gravel. It is on terraces, outwash plains, and moraines. Map units are irregular in shape and are dominantly about 10 acres.

In a typical profile, the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown and

Figure 3.—Crop residue on Boyer sandy loam, 0 to 6 percent slopes.

brown, friable sandy loam, and the lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches or more is brown gravelly coarse sand. Some areas do not have gravel in the subsoil and underlying material, and other areas have a thicker surface layer and subsoil. In places there is more clay in the surface layer and subsoil. In a few areas, cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few areas of very poorly drained, depressional Sebewa soils. Also included are a few areas of soils that have slopes of less than 6 percent or more than 12 percent. These inclusions make up about 5 to 10 percent of the unit.

The available water capacity of this Boyer soil is low. Permeability is moderately rapid in the surface layer and subsoil and very rapid in the underlying material. Surface runoff is medium, and the organic matter content is moderate. The surface layer is friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is suited to corn, soybeans, and small grains. Erosion is the main hazard. Conservation measures, such as contour farming and cover crops, help to control erosion. Droughtiness is a hazard, especially for row crops during extended dry periods. Conservation tillage that leaves all or part of the crop residue on the surface reduces erosion, helps retain moisture, and improves and maintains the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture, which is an effective way to control erosion. Droughtiness is a hazard for shallow-rooted grasses. Proper stocking, pasture rotation, and favoring deep-rooted species help keep the pasture and soil in good condition.

This soil is suited to trees. Droughtiness is a management concern. Species of trees tolerant to low moisture conditions should be favored in stands.

The use of this soil for building sites and local roads and streets is moderately limited by slope. Buildings can be designed to complement the slope. Roads and streets may need cutting and filling in addition to being built on the contour to overcome slope. The use of this soil for septic tank absorption fields is severely limited by poor filtering qualities. This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in the pollution of ground-water supplies.

This soil is in capability subclass IIIe and woodland suitability subclass 3o.

CrA—Conover loam, 0 to 3 percent slopes. This nearly level, deep, somewhat poorly drained soil is in concave areas of moraines. Areas are irregular in shape. They range from 3 to 50 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 19 inches thick. It is dark grayish brown, mottled, friable clay loam in the upper part and dark yellowish brown, mottled, friable loam in the lower part. The underlying material to a depth of 60 inches or more is brown, mottled loam. In places the lower part of the subsoil is stratified silty clay loam, clay loam, and sandy loam. In some areas the subsoil is as much as 10 percent gravel. The depth of calcareous glacial till is more than 40 inches in some places. In some places this soil has more clay in the subsoil and underlying material. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are areas of Strawn and Rensselaer soils. The well drained Strawn soils have a thinner surface layer and subsoil and are on slightly higher positions than the Conover soil, and the very poorly drained Rensselaer soils have a grayer subsoil and are on lower depressional positions. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Conover soil is moderate, and permeability is moderately slow. Surface runoff is medium, and the organic matter content is high. The water table is at a depth of 1 foot to 2 feet in the winter and spring. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are in woodland.

This soil is well suited to corn, soybeans, and small grains. The main limitation for growing row crops is wetness. Subsurface drains can lower the high water table, provided adequate outlets are available. Conservation tillage that leaves all or part of the crop residue on the surface improves and helps maintain tilth and the organic matter content of the soil.

This soil is well suited to grasses and legumes for hay and pasture. The main limitation is wetness. Surface and subsurface drains can be used to lower the water table. Proper stocking, proper fertilization, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is the main management concern, which can be reduced by cutting, girdling, or spraying.

The use of this soil for building sites is severely limited by wetness. Subsurface drains can be installed, however, to lower the water table. Foundations, footings, and basement walls should be strengthened and backfilled with a coarser material to help prevent structural damage from shrinking and swelling. The use of this soil for local roads and streets is severely limited by low strength and frost action. Providing adequate drainage along roads reduces possible damage from frost action. The base material will need replacing or strengthening with a more suitable material to support vehicular traffic.

The use of this soil for septic tank absorption fields is severely limited by wetness and moderately slow permeability. Filling or mounding with a more suitable fill material to raise the absorption field can reduce the wetness and increase permeability. Drains around the outer edges of the absorption field remove excess water.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

Em—Eel loam, frequently flooded. This nearly level, deep, moderately well drained soil is on bottom land along streams. This soil is flooded frequently for brief periods (fig. 4). Areas are irregular and elongated in shape and range from 3 to 200 acres.

In a typical profile, the surface layer is dark grayish brown loam about 9 inches thick. The underlying material to a depth of about 39 inches is yellowish brown, mottled, friable loam. Below this to a depth of 52 inches is yellowish brown, mottled, firm clay loam. Below this to a depth of 60 inches or more is very dark gray, mottled fine sandy loam. In some areas strata of sand and gravelly sand are below a depth of 40 inches.

Included with this soil in mapping are a few small depressional areas of poorly drained soils that have a gray mottled subsoil. Also included are some small area of soils that have gravelly sand at a depth of about 24 inches or that have less clay throughout. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Eel soil is high, and permeability is moderate. Surface runoff is slow, and the organic matter content is moderate. The water table is at a depth of 3 to 6 feet in winter and early spring. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is suited to corn and soybeans. Frequent flooding in the spring is the main hazard, and late

Figure 4.—Eel soils are subject to frequent flooding.

planting or replanting is sometimes necessary to overcome it. Conservation tillage that leaves all or part of the crop residue on the surface improves and helps maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, rotational grazing, and restricted use during wet periods reduce surface compaction and help to maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled. The control or removal of unwanted trees and shrubs can be accomplished by site preparation or by spraying, cutting, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited by flooding and wetness. It is generally not suited to these uses. The use of this soil for roads is severely limited by flooding and frost action. Constructing roads on raised, well compacted fill material and providing side ditches and culverts protect them from flooding and frost action.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

GnB2—Glynwood loam, 3 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained soil is on broad, convex side slopes in an area of undulating soils that formed in glacial till (fig. 5). Areas are broad and irregular in shape and range from 5 to 80 acres.

In a typical profile, the surface layer is about 9 inches thick. It is brown loam that contains about 15 percent dark yellowish brown material. The subsoil is about 19 inches thick. It is dark yellowish brown, mottled, firm clay. The underlying material to a depth of 60 inches or more is dark yellowish brown and brown, mottled clay loam. Some small areas of this soil are sandy loam or loamy sand in the surface layer and upper part of the

Figure 5.—A typical landscape of Glynwood loam, 3 to 6 percent slopes, eroded. Pewamo silty clay and Wallkill silt loam are in depressions.

subsoil. A few small areas do not have mottles of low chroma in the subsoil. In places the surface layer is loam. Some small areas are underlain by pockets of sand or stratified sand and gravelly sand. In places the underlying material has less clay. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small areas of the somewhat poorly drained, nearly level Blount soils and the well drained, moderately sloping, severely eroded Morley soils. Also included are a few small depressional areas of very poorly drained Pewamo and Bono soils. The moderately well drained or well drained, less clayey Rawson soils are included in some areas near the tops of ridges. Also included are a few small areas of well drained Strawn soils that are on higher positions than the Glynwood soil and a few small areas of soils that have slopes of more than 6 percent, especially along major tributaries. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Glynwood soil is moderate, and permeability is slow. Surface runoff is rapid, and the organic matter content is moderate. The water table is at a depth of 2 to 3 1/2 feet during winter and spring. This soil has a surface layer that becomes cloddy and hard to work if tilled when wet.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are in woodland.

This soil is well suited to corn, soybeans, and small grains. Erosion is the major hazard. Crop rotation, grade stabilization structures, and conservation tillage that leaves all or part of the crop residue on the surface reduce the erosion hazard.

This soil is well suited to grasses and legumes for hay or pasture. The hazard of erosion is minimal when a good vegetative cover is maintained. Overgrazing or

grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking and restricted use during wet periods reduce surface compaction and help maintain good tilth and plant density.

This soil is well suited to trees. Seedling mortality, windthrow losses, and plant competition are management concerns. Special site preparation, such as bedding, is needed in some areas. Harvesting methods should be used that do not leave trees standing alone or widely spaced. Trees survive and grow well when competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for dwellings without basements is moderately limited and for dwellings with basements is severely limited by wetness and shrinking and swelling. The installation of subsurface drains can lower the water table. Foundations, footings, and basement walls should be strengthened. Backfilling with a coarser material helps prevent structural damage from shrinking and swelling of the soil. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion.

The use of this soil for local roads and streets is severely limited by low strength and frost action. Providing adequate drainage along roads reduces possible damage from frost action. The base material will need replacing or strengthening with a more suitable material to support vehicular traffic. The use of this soil for septic tank absorption fields is severely limited by wetness and slow permeability. Filling or mounding with a more suitable fill material to raise the absorption field reduces the permeability problem. Drains around the outer edges of the absorption field remove excess water.

This soil is in capability subclass IIe and woodland suitability subclass 2c.

HaA—Haskins loam, 0 to 3 percent slopes. This nearly level, deep, somewhat poorly drained soil is on terraces and moraines. Areas are irregular in shape. They range from 2 to 35 acres but are dominantly about 8 acres.

In a typical profile, the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is about 19 inches thick. The upper part is grayish brown, mottled, friable loam; the middle part is yellowish brown, mottled, friable sandy clay loam; and the lower part is dark grayish brown, mottled, friable sandy loam. The underlying material to a depth of 60 inches or more is brown, mottled clay loam. In some small areas more clay is in the lower part of the subsoil and underlying material. Some areas may be stratified with loamy materials in the lower part of the subsoil and underlying material.

Included with this soil in mapping are small areas of moderately well drained Glynwood soils and moderately well drained or well drained Rawson soils. Also included are small areas of less sandy Blount soils that are on similar landscape positions. The very poorly drained Pewamo and Rensselaer soils are included in depressional areas. These inclusions make up about 1 to 10 percent of the unit.

The available water capacity of this Haskins soil is moderate. Permeability is moderate in the upper part of the subsoil and slow in the lower part of the subsoil and the underlying material. Surface runoff is slow, and the organic matter content is moderate. The water table is at a depth of 1 foot to 2 1/2 feet during the winter and spring. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are used for woodland.

This soil is well suited to corn, soybeans, and small grains. Wetness is the main limitation; but subsurface drains can lower the high water table, provided adequate outlets are available. Conservation tillage that leaves all or part of the crop residue on the surface helps maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. Artificial drainage helps maintain high yields. Proper stocking, pasture rotation, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density and hardiness.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled. This can be accomplished by site preparation or by spraying, cutting, or girdling.

The use of this soil for building sites is severely limited by wetness. The installation of subsurface drains can lower the water table. The use of this soil for local roads and streets is severely limited by frost action. Providing adequate drainage along roads and replacing or strengthening the base materials with a more suitable material to support vehicular traffic reduce possible damage from frost action. The use of this soil for septic tank absorption fields is severely limited by wetness and moderately slow permeability. Filling or mounding with a more suitable fill material to raise the absorption field can reduce wetness and increase permeability. Drains around the outer edges of the absorption field remove excess water.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

HdB—Hillsdale fine sandy loam, 2 to 10 percent slopes. This gently sloping and moderately sloping, deep, well drained soil is on moraines. Areas are irregular in shape and are dominantly about 20 acres.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and dark yellowish brown, friable fine sandy loam

in the upper part and yellowish brown, friable sandy clay loam in the lower part. The substratum to a depth of 60 inches or more is light yellowish brown fine sandy loam. In places it is calcareous within 40 inches of the surface. Also, in places, there is more clay in the subsoil. In places the underlying material is high in content of sand. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few areas of lower lying, somewhat poorly drained Conover soils and a few areas of higher lying, more clayey Strawn soils. Also included are a few small areas of soils that have more than 10 percent slope. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Hillsdale soil is moderate, and permeability is moderately rapid. Surface runoff is slow, and the organic matter content is moderate. The surface layer is friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grains. Erosion is the main hazard. Droughtiness is a hazard especially for shallow-rooted crops during extended dry periods. Crop rotation, conservation tillage that leaves all or part of the crop residue on the surface, grassed waterways, or grade stabilization structures help prevent excessive soil loss. The return of crop residue to the soil and cover crops also improve and help to maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. The use of this soil for this purpose is effective in controlling wind and water erosion. Droughtiness is a hazard, especially for shallow-rooted grasses. Proper stocking, pasture rotation, and favoring deep-rooted species help to maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Tree cuttings and seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by site preparation or by spraying, cutting, or girdling. Droughtiness may be a hazard. Species of trees tolerant to low moisture conditions should be favored in stands.

Most of this soil is suited to building sites. Slope is a moderate limitation where it is more than 8 percent. Buildings can be designed to complement the slope in these areas. Most of this soil is suited to local roads and streets. Areas where slopes are more than 8 percent are moderately limited for local roads and streets. These areas may require cutting and filling, and roads should be built on the contour. Most of this soil is suited to septic tank absorption fields. Where slope is more than 8 percent, it is a moderate limitation. Land shaping or installing distribution lines on the contour may be necessary for proper functioning of the absorption field.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

Hw—Houghton muck, drained. This nearly level, deep, very poorly drained organic soil is in broad, depressional areas of the upland and in narrow, elongated areas of the lowland. These areas are frequently ponded by runoff from adjacent soils. Areas are irregular in shape. They range from 2 to 160 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is black muck about 7 inches thick. The underlying material, to a depth of 51 inches, is black and dark reddish brown muck that increases in fiber content with depth. Below this to a depth of 60 inches or more is brown muck.

Included with this soil in mapping are small areas of the mineral Pewamo, Bono, and Rensselaer soils which are on slightly higher positions on the landscape than the Houghton soil. Sedimentary peat or mineral material is at a depth of about 20 to 50 inches in some areas. There are small areas of undrained muck and a few areas of muck less than 16 inches deep. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Houghton soil is very high, and permeability is moderately slow to moderately rapid. Surface runoff is very slow or ponded, and the organic matter content is very high. The water table is at or above the surface during the fall, winter, and spring. If properly drained, muck is easily tilled.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, and specialty crops. A few areas are in woodland and are generally inadequately drained.

This soil is suited to corn and soybeans. Specialty crops such as mint and vegetables are occasionally grown on this soil. Houghton muck is subject to ponding, wind erosion, and fire damage. Open ditches and subsurface drains reduce the period of ponding and lower the water table, thereby increasing the time available for germination and the depth available for rooting of crops (fig. 6). Overdrainage of muck can accelerate the rate of subsidence, but raising the water table during fallow periods will slow the rate. Dry, unprotected muck is subject to soil blowing. Maintenance of a cover crop or crop residue management helps prevent soil blowing.

This soil is suited to grasses for hay or pasture. Legumes, especially deep-rooted legumes, are poorly suited to this soil. This soil is subject to ponding and subsidence. Open ditches and subsurface drains can reduce the damage from ponding by decreasing the period of ponding. Artificial drainage will not prevent ponding, but it is needed to lower the water table so that the time for seed germination and the rooting depth can be increased. Overdrainage of muck can accelerate subsidence. Proper stocking, pasture

Figure 6.—Houghton muck, drained, is used mainly for corn.

rotation, and restricted use during wet periods help maintain good plant density.

This soil is poorly suited to trees. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Maintaining a drainage system and planting water tolerant species can help overcome these limitations. Harvesting of trees should be restricted to dry periods or when the ground is frozen. Tree cuttings and seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by site preparation or by spraying, cutting, or girdling.

The use of this soil for building sites and septic tank absorption fields is severely limited by ponding. It is generally not suited to these uses. It is severely limited for roads by ponding, low strength, and frost action. The organic layers of the soil should be replaced with suitable fill material to overcome the low strength. Constructing side ditches and culverts to provide adequate drainage helps prevent damage from ponding and frost action.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Ld—Landes fine sandy loam, frequently flooded. This nearly level, deep, moderately well drained and well drained soil is on flood plains. It is frequently flooded for brief periods. Areas are irregular and elongated in shape and are dominantly about 35 acres.

In a typical profile, the surface layer is very dark grayish brown fine sandy loam about 12 inches thick. The subsoil is brown, friable fine sandy loam about 24 inches thick. The underlying material to a depth of 60 inches or more is dark yellowish brown and brown loam and silt loam. Some areas have a lighter colored surface layer. In some small areas gray mottles are within a depth of 20 inches.

Included with this soil in mapping are a few areas of a soil which has more clay throughout. Also included are soils along old stream channels which are wetter than

the Landes soil and are often ponded during the year. In some small areas, slopes are more than 2 percent. Also included are some areas that are underlain with loamy sand, sand, and gravelly sand at a depth of 40 to 60 inches. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Landes soil is moderate, and permeability is moderately rapid to rapid. Surface runoff is slow, and the organic matter content is moderate. The water table is at a depth of 4 to 6 feet in the spring. The surface layer is friable and easily tilled throughout a wide range in moisture content.

Most of this soil is used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is suited to corn and soybeans. It is susceptible to flooding. Late planting or replanting is sometimes necessary after flooding.

This soil is well suited to grasses and legumes for hay and pasture. Droughtiness is a hazard, especially for shallow-rooted grasses. Proper stocking, pasture rotation, and favoring deep-rooted species reduce surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Tree cuttings and seedlings survive and grow well if competing vegetation is controlled or removed. This can be accomplished by site preparation or by spraying, cutting, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited by flooding. It is generally not suited to these uses. The use of this soil for roads is severely limited. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts protect them from flood damage.

This soil is in capability subclass IIIw and woodland suitability subclass 1o.

Mc—Martisco muck, undrained. This nearly level, deep, very poorly drained soil is in marshy depressions on old lakebeds. These soils are frequently ponded by runoff from adjacent areas. Areas are irregular in shape. They range from 2 to 50 acres but are dominantly 10 acres.

In a typical profile, the surface layer is black muck about 10 inches thick. The underlying material to a depth of 60 inches or more is gray or light grayish brown marl. In some areas the organic layer is either thicker or thinner than typical.

Included with this soil in mapping are areas of deep, organic Houghton soils in the lower depressional positions. Also included are the mineral Rensselaer soils which are higher on the landscape than the Martisco soil and small areas of soils with mineral soil material at a depth of 50 inches or less. These inclusions make up about 5 to 10 percent of the unit.

The available water capacity of this Martisco soil is high, and permeability is slow. Surface runoff is very slow or ponded, and the organic matter content is very high. If properly drained, this soil is easily tilled. The water table is at or above the surface in the fall, winter, and spring.

Most areas of this soil are in woodland. Some areas are used for hay and pasture.

This soil is poorly suited to corn, soybeans, and small grains. It is subject to ponding, and many areas do not have an adequate outlet to allow subsurface drainage.

This soil is poorly suited to grasses and legumes for hay and pasture. This soil is subject to ponding. Most areas of this soil do not have an adequate outlet for artificial drainage. Proper stocking, pasture rotation, and restricted use during wet periods help maintain good plant density.

This soil is poorly suited to trees because of wetness. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Harvesting of trees can be delayed to dry seasons or when the ground is frozen. Harvesting methods should be used that do not leave trees standing alone or widely spaced. Planting water-tolerant species and cutting, girdling, and spraying of undesirable species may reduce these limitations.

The use of this soil for building sites and sanitary facilities is severely limited by ponding. It is generally not suited to these uses. The use of this soil for roads is severely limited by ponding, low strength, and frost action. The organic layers of the soil need to be replaced with suitable soil material to overcome the low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts protect them from ponding and frost damage.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

MfB—Metea loamy sand, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on rises of the till plain, moraines, and gently sloping areas along drainageways. Areas are irregular in shape and range from 3 to 34 acres.

In a typical profile, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown and dark yellowish brown, very friable loamy sand and sand about 20 inches thick. The subsoil is about 11 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is dark yellowish brown, firm clay. The calcareous underlying material to a depth of 60 inches or more is yellowish brown clay loam. Some areas are deeper to the calcareous underlying glacial till.

Included with this soil in mapping are the somewhat poorly drained Blount soils that are on the lower positions on the landscape and the moderately well drained Glynwood soils in lower lying areas. Also included are areas of soils that have slopes of 6 to 12 percent. A few small lower lying areas of the more sandy Boyer soils and the moderately well drained or well

drained, more clayey Rawson soils are also included. These inclusions make up about 5 to 12 percent of the unit.

The available water capacity of this Metea soil is low. Permeability is rapid in the surface and subsurface layers and slow in the subsoil and underlying material. Surface runoff is slow, and the organic matter content is low. The surface layer is very friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few areas are in woodland.

This soil is suited to corn, soybeans, and small grains. Where row crops are grown, the main limitation is the hazard of erosion. Droughtiness and soil blowing are also limitations. Low available water capacity is a limitation of the soil. Blowing sand often covers up or cuts off crop seedlings. Conservation tillage that leaves all or part of the crop residue on the surface, crop rotation, and grade stabilization structures help control excessive erosion and surface water runoff. Cover crops and crop residue management also help to control erosion and improve and maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. The main hazard is erosion. Maintenance of a good vegetative cover and plant population decreases the hazard of wind and water erosion. Proper stocking and pasture rotation help keep the pasture and soil in good condition.

This soil is well suited to trees, but only a few areas remain in woodland. Seedling mortality is the main management concern. Replanting may be necessary. Droughtiness is a hazard. Species of trees tolerant to low moisture conditions should be favored in stands. Seedlings survive and grow well when competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is moderately limited by shrinking and swelling. Foundations, footings, and basement walls should be strengthened. Backfilling with a coarser material below a depth of about 35 inches helps prevent structural damage caused by shrinking and swelling of the soil. The use of this soil for local roads and streets is moderately limited by low strength and frost action. It may be necessary to replace layers of the soil that have a moderate shrink-swell potential and cover the soil surface with suitable base material.

The use of this soil for septic tank absorption fields is severely limited by slow permeability, but this concern can be reduced by replacing the slowly permeable material with more permeable material.

This soil is in capability subclass IIIe and woodland suitability subclass 2s.

MoC2—Morley silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on the dissected parts of till plains and moraines. Areas are irregular in shape and are dominantly about 9 acres.

In a typical profile, the surface layer is about 8 inches thick. It is about 90 percent dark grayish brown silt loam and 10 percent dark brown material. The subsoil is about 17 inches thick. The upper part is dark brown, firm silty clay loam, and the lower part is brown or dark brown, firm clay. The underlying material to a depth of 60 inches or more is calcareous, brown silty clay loam. In places the underlying material is sand and gravel, and in other places it has less clay than in the typical profile. In places the depth to calcareous material is less than 20 inches. In some places the upper part of the subsoil is mottled. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small areas of the somewhat poorly drained, nearly level or gently sloping Blount soils and the moderately well drained or well drained, gently sloping Rawson soils. The Rawson soils are sandier in the upper part than the Morley soil. Also included are a few small areas of higher lying, well drained, less clayey Strawn soils. In some small areas the soil is eroded and has slopes of less than 6 percent, and in others it is severely eroded and has slopes of more than 12 percent. These inclusions make up about 2 to 8 percent of the unit.

The available water capacity of this Morley soil is moderate, and permeability is slow. Surface runoff is medium, and the organic matter content is moderate. The surface layer has a tendency to crust or puddle after heavy rains, especially in areas where the plow layer is mostly subsoil material.

Most areas of this soil are used for cultivated crops. Some areas are used for hay, pasture, or woodland.

This soil is suited to corn, soybeans, and small grains. Erosion is the main hazard if this soil is cultivated. Conservation tillage that leaves all or part of the crop residue on the surface, crop rotation, terracing, and grassed waterways control or decrease soil erosion and gullying.

This soil is well suited to grasses and legumes for hay or pasture. Maintenance of a good vegetative cover may adequately control erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is moderately limited by shrinking and swelling and slope. Foundations, footings, and basement walls should be strengthened. Backfilling with a coarser material helps prevent structural damage from shrinking and swelling of the soil. Buildings should be designed to complement the slope.

Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is severely limited by low strength. The base material for roads will need strengthening or replacing with a more suitable material to support vehicular traffic.

The use of this soil for septic tank absorption fields is severely limited by slow permeability. Land shaping and installing the distribution line across the slope generally is necessary for proper functioning of the absorption field. Filling or mounding with a more suitable fill material raises the absorption field and reduces the permeability problem.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

MoD2—Morley silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on the dissected parts of till plains and moraines. Areas are irregular in shape and are dominantly about 10 acres.

In a typical profile, the surface layer is about 7 inches thick. It is about 85 percent dark grayish brown silt loam and 15 percent brown material. The subsoil is brown or dark yellowish brown, firm clay loam and clay about 16 inches thick. The underlying material to a depth of 60 inches or more is calcareous, brown silty clay loam. In places the underlying material is sand and gravel, and in other places it has less clay than typical. In places the depth to calcareous material is less than 20 inches. In some places the upper part of the subsoil is mottled. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small areas of the adjacent somewhat poorly drained, nearly level or gently sloping Blount soils and the moderately well drained or well drained, gently sloping, more sandy Rawson soils. Also included are some small eroded areas of a less sloping soil and some small areas where slopes are 18 to 25 percent. A few small areas of higher lying, less clayey Strawn soils are also included. These inclusions make up about 2 to 5 percent of the unit.

The available water capacity of this Morley soil is moderate, and permeability is slow. Surface runoff is medium, and the organic matter content is moderate. The surface layer has a tendency to crust or puddle after heavy rains, especially in areas where the plow layer is mostly subsoil material.

Most areas of this soil are used for woodland. Some areas are used for hay and pasture. A few areas are used for cultivated crops.

This soil is poorly suited to corn, soybeans, and small grains. Erosion is the main hazard if these soils are cultivated. Crop rotation, conservation tillage that leaves all or part of the crop residue on the surface, grassed waterways, and cover crops are needed to reduce excessive soil erosion.

This soil is suited to grasses and legumes for hay and pasture. Maintenance of a good cover crop is a very effective way of controlling erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Erosion hazard, equipment limitations, and plant competition are management concerns. The use of equipment is difficult on these strongly sloping soils. Proper management of ground cover, placing logging roads on the contour, and timely use of equipment when the topsoil is dry and firm reduce soil erosion. Seedlings survive and grow well when competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is severely limited by slope. Buildings should be designed to complement the slope. Land shaping and installing retaining walls also help. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is severely limited by slope and low strength. Cutting and filling may be needed, and roads should be built on the contour where possible. It may be necessary to replace layers of the soil that have a high shrink-swell potential and low strength.

The use of this soil for septic tank absorption fields is severely limited by slope and slow permeability. These limitations can be overcome by installing the absorption field on the contour and filling or mounding with a more permeable material.

This soil is in capability subclass IVe and woodland suitability subclass 2r.

MoE2—Morley silt loam, 18 to 30 percent slopes, eroded. This moderately steep and steep, deep, well drained soil is on the dissected parts of till plains and moraines. Areas are narrow and elongated and are dominantly about 8 acres.

In a typical profile, the surface layer is about 6 inches thick. It is about 80 percent dark grayish brown silt loam and 20 percent brown material. The subsoil is dark yellowish brown, firm clay loam and clay about 15 inches thick. The underlying material to a depth of 60 inches or more is calcareous, brown clay loam. In places the surface layer is silty clay loam. Also in places there is less clay in the underlying material. In places the depth to calcareous material is less than 20 inches. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small caplike areas of moderately well drained or well drained, more sandy Rawson soils near the tops of ridges. Also included are a few small areas where slopes are less than 18 percent and more than 30 percent. These inclusions make up about 2 to 5 percent of the unit.

The available water capacity of this Morley soil is moderate, and permeability is slow. Surface runoff is rapid, and the organic matter content is moderate. Most areas of this soil are used for hay, pasture, or woodland.

This soil is generally unsuitable for corn, soybeans, and small grains because of the severe hazard of erosion. The steepness of the slope makes it difficult to use standard farm machinery.

This soil is suited to grasses and legumes for pasture. It is poorly suited to hay because slope makes haying difficult. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth. Proper stocking, pasture rotation, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to trees. Erosion hazard, equipment limitation, and plant competition are management concerns. Proper management of ground cover, placing logging roads on the contour, and timely use of equipment when the topsoil is dry and firm reduce soil erosion. Seedlings survive and grow well if competing vegetation is controlled by spraying, cutting, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited. It is generally unsuitable for these uses. The use of this soil for roads is severely limited by slope and low strength. Cutting and filling may be needed, and roads should be built on the contour where possible. The high shrink-swell layers of the soil should be replaced with suitable soil material to overcome low strength. Existing vegetation should be disturbed as little as possible during road construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

MrC3—Morley silty clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on the dissected parts of glacial till plains and moraines. Slopes are short and convex. Areas are irregular in shape and are dominantly about 8 acres.

In a typical profile, the surface layer is brown silty clay loam about 7 inches thick. The subsoil is dark yellowish brown, firm silty clay loam and silty clay about 15 inches thick. The underlying material to a depth of 60 inches or more is calcareous, brown silty clay loam. In places there is less clay in the underlying material. Also in places the depth to calcareous material is less than 20 inches. In some places the upper part of the subsoil is mottled. In a few areas cobbles cover 1 to 5 percent of the surface.

Included with this soil in mapping are areas of Blount, Glynwood, and Rawson soils. The somewhat poorly drained Blount soils are nearly level and gently sloping. The moderately well drained or well drained, more sandy Rawson soils are on sloping positions on the landscape. Also included are some small eroded areas where slopes are 6 to 18 percent and some severely eroded areas where slopes are 12 to 18 percent. Also included are a few small areas of higher lying, less clayey Strawn soils. These inclusions make up about 2 to 8 percent of the unit.

The available water capacity of this Morley soil is moderate, and permeability is slow. Surface runoff is rapid, and the organic matter content is low. This soil becomes cloddy if tilled when wet, which makes seedbed preparation difficult.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. Only a few areas are used for woodland.

This soil is poorly suited to corn, soybeans, and small grains. Erosion is a severe hazard. Crop rotation, grade stabilization structures, grassed waterways, terracing, and conservation tillage that leaves all or part of the crop residue on the surface are needed to control erosion.

This soil is well suited to grasses and legumes for hay and pasture. Maintenance of a good pasture or hay crop is an effective way to minimize erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is severely limited by shrinking and swelling and slope. Foundations, footings, and basement walls should be strengthened. Backfilling with a coarser material helps prevent structural damage caused by shrinking and swelling of the soil. Buildings should be designed to complement the slope. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is severely limited by low strength. The base material for roads will need strengthening or replacing with a more suitable material to support vehicular traffic. The use of this soil for septic tank absorption fields is severely limited by slow permeability, but this can be reduced by filling or mounding with a more permeable material.

This soil is in capability subclass IVe and woodland suitability subclass 2o.

MrD3—Morley silty clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on the dissected parts of till plains and moraines. The slopes are short and convex. Areas are elongated or irregular in shape and are dominantly about 6 acres.

In a typical profile, the surface layer is brown silty clay loam about 6 inches thick. The subsoil is dark yellowish brown, firm silty clay loam and silty clay about 14 inches thick. The underlying material to a depth of 60 inches or more is calcareous, brown silty clay loam. In places the underlying material is sand and gravel, and in other places it has less clay. In places the depth to calcareous material is less than 20 inches. In a few areas cobbles cover 1 to 5 percent of the surface.

Included with this soil in mapping are small areas of somewhat poorly drained Blount soils on lower lying positions and a few small areas of higher lying, less clayey Strawn soils. Also included are some small areas where slopes are 2 to 12 percent and 18 to 30 percent. These inclusions make up about 2 to 5 percent of the unit.

The available water capacity of this Morley soil is moderate, and permeability is slow. Surface runoff is rapid, and the organic matter content is low. This soil becomes cloddy if tilled when wet, which makes seedbed preparation difficult.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture. A few areas are in woodland.

This soil is generally unsuitable for corn, soybeans, and small grains because of the severe hazard of erosion. The steepness of the slope makes it difficult to use most standard farm machinery.

This soil is suited to grasses and legumes for hay and pasture. Erosion and slope are severe hazards. Maintenance of a good vegetative cover is an effective way of minimizing erosion. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Erosion hazard, equipment limitation, and plant competition are management concerns. Logging roads may need to be built on the contour to help minimize erosion and equipment hazards. Proper management of ground cover reduces soil erosion. Seedlings survive and grow well when competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is severely limited by slope. Buildings should be designed to complement the slope. Land shaping and installing retaining walls will also help. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is severely limited by slope and low strength. Cutting and filling may be needed, and roads should be built on the contour where possible. It may be necessary to replace the layers of the soil that have a high shrink-swell potential.

The use of this soil for septic tank absorption fields is severely limited by slope and slow permeability. These limitations can be overcome by installing the absorption field on the contour and filling or mounding with a more permeable material.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

OdB—Ormas loamy sand, 0 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on outwash terraces along the St. Joseph River. Areas are broad and irregular in shape and range from about 20 to 100 acres.

In a typical profile, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer, to a depth of 38 inches, is brown loamy sand. It has color and texture bands in the lower part. The subsoil is about 17 inches thick. The upper part is brown, friable sandy loam, and the lower part is brown, firm gravelly sandy clay loam. The underlying material to a depth of 60 inches or more is brown gravelly coarse sand. In places the depth to sand or gravelly sand is less than 50 inches. In some areas the subsurface layer has no bands in the lower part or bands extend below a depth of 40 inches. Some small areas have a sandy loam surface layer.

Included with this soil in mapping are small wetter areas of a soil in depressional positions and areas where loam till is within a depth of 60 inches. Also included are areas where slopes are more than 6 percent. These inclusions make up about 5 to 12 percent of the unit.

The available water capacity of this Ormas soil is moderate. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. Surface runoff is slow, and the organic matter content is moderate. This soil has a surface layer that is easy to till throughout a wide range in moisture content.

Most of this soil is used for cultivated crops. Some irrigated areas are used for special crops. Some areas are in pasture, hay, or woodland.

This soil is suited to corn, soybeans, and small grains. Droughtiness is a limitation, and water and wind erosion (fig. 7) are hazards. Where feasible, irrigation can increase yields. Conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, and grade stabilization structures help to control erosion and improve and maintain the moisture and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Deep-rooted plants should be favored to reduce the hazard of droughtiness. This use of the soil is effective in controlling wind and water erosion. Overgrazing reduces plant density and hardiness, which can be maintained by proper stocking, rotational grazing, and maintaining the level of organic matter.

This soil is suited to trees. Species of trees tolerant to low moisture conditions should be favored in stands.

Figure 7.—Wind erosion can be a problem on unvegetated Ormas loamy sand, 0 to 6 percent slopes.

Seedling mortality and plant competition are the main management concerns. Seedlings survive and grow well if competing vegetation is controlled by spraying, cutting, or girdling.

This soil is suited to building sites. The use of this soil for local roads and streets is moderately limited by frost action. Replacing or covering the upper soil layers with suitable base material reduces damage from frost action. This soil is suitable for septic tank filter fields.

This soil is in capability subclass IIIs and woodland suitability subclass 3s.

OhB—Oshtemo sandy loam, 0 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on outwash plains and terraces along drainageways and moraines. Areas are irregular in shape and are dominantly about 30 acres.

In a typical profile, the surface layer is brown sandy loam about 12 inches thick. The dark yellowish brown, friable subsoil is about 35 inches thick. The upper part is sandy loam, the next part is gravelly sandy loam, and the lower part is fine sandy loam. The underlying material to a depth of 60 inches or more is brown gravelly coarse sand. In some areas about 20 to 30 inches of loamy sand is in the upper part of the soil. In some areas sand and gravel are at a depth of less than 40 inches, and in other areas they are at a depth of more than 60 inches. In places there is more clay in the subsoil.

Included with this soil in mapping are small areas of a soil that has developed in windblown sands which are stratified with bands of sandy loam. There are also some wetter areas in depressional positions and areas where the glacial till is within a depth of 60 inches. Also included are areas where slopes are more than 6 percent. These inclusions make up about 5 to 12 percent of the unit.

The available water capacity of this Oshtemo soil is moderate. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. Surface runoff

s slow, and the organic matter content is low. The surface layer is friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some areas are in pasture, hay, or woodland.

This soil is suited to corn, soybeans, and small grains. Droughtiness and erosion are hazards especially for cultivated crops. Where feasible, irrigation increases yields. Conservation tillage that leaves all or part of the crop residue on the surface, winter cover crops, and grade stabilization structures help to control erosion and improve and maintain moisture and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. Deep-rooted plants should be favored to reduce the hazard of droughtiness. The use of this soil for this purpose is effective in controlling wind and water erosion. Overgrazing reduces plant density and hardiness. Proper stocking and rotational grazing help to maintain good tilth and plant density.

This soil is suited to trees. Species of trees tolerant to low moisture conditions should be favored in stands.

This soil is suited to building sites and local roads and streets. It is also suitable for septic tank absorption fields; although in some areas they may cause the pollution of ground water supplies.

This soil is in capability subclass IIIs and woodland suitability subclass 3o.

Pe—Pewamo silty clay. This nearly level, deep, very poorly drained soil is on broad flats or in narrow depressions on till plains and moraines. These areas are frequently ponded by surface water runoff from adjacent soils. Areas are irregular in shape. They range from about 3 to 80 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is black silty clay about 10 inches thick. The subsoil is dark gray and gray, mottled, firm silty clay about 24 inches thick. The underlying material to a depth of 60 inches or more is dark grayish brown, mottled silty clay loam. In some places about 18 inches of silty overwash material is on the surface. Some areas have less than 10 inches of dark surface soil. In places there are underlying pockets of sand and gravelly sand. In some places there is less clay in the subsoil and underlying material. In some areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small areas of somewhat poorly drained Blount soils on slightly higher positions on the landscape than the Pewamo soil. Also included are small depressional areas of Houghton, Rensselaer, and Wallkill soils. Houghton soils are mucky throughout, and Rensselaer and Wallkill soils have less clay. A few areas of higher lying, somewhat poorly drained Haskins soils are also included. These inclusions make up about 2 to 12 percent of the unit.

The available water capacity of this Pewamo soil is high, and permeability is moderately slow. Surface runoff is slow or ponded, and the organic matter content is high. The water table is at or above the surface during the winter and spring. Tilling this soil when it is too wet causes large clods to form, which makes seedbed preparation difficult.

Most areas of this soil have been drained (fig. 8) by subsurface drains and open ditches and are used for cultivated crops. Some areas are used for hay and pasture. A few areas are in woodland.

Adequately drained areas of this soil are well suited to corn, soybeans, and small grains. Ponding is a hazard, and wetness is the main limitation. Excess water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. Conservation tillage that leaves all or part of the crop residue on the surface improves and helps maintain tilth and the organic matter content of the soil.

This soil is well suited to grasses and legumes for hay and pasture. Deep-rooted legumes, such as alfalfa, are not well suited to this soil. Drainage is necessary to obtain high yields. Overgrazing or grazing when the soil is wet causes surface compaction, poor tilth, and poor plant density. Proper stocking, pasture rotation, and restricted use during wet periods reduce surface compaction and help maintain good tilth and plant density.

This soil is suited to trees. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Harvesting is delayed until dry periods or when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited. It is generally unsuitable for these uses. The use of this soil for roads is severely limited by ponding, low strength, and frost action. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect them from ponding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

RaB—Rawson sandy loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained or well drained soil is on low ridges and knolls on the till plain and on terraces along drainageways and streams. Areas are irregular in shape and range from about 2 to 20 acres.

In a typical profile, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 29 inches thick. The upper part is dark yellowish brown, friable sandy loam or loam; the next part is brown, firm clay loam; and the lower part is dark yellowish brown, friable loam. The underlying material to a depth of 60 inches or more is brown, firm silty clay loam. Some

Figure 8—A small undrained area of Pewamo silty clay.

areas are underlain by stratified fine sands and silts. Some areas have less clay in the lower part of the subsoil and underlying material, and other areas have more clay in the subsoil. Some areas have a thinner subsoil. In a few areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are some small areas of Blount, Boyer, Glynwood, and Haskins soils. The somewhat poorly drained Blount and Haskins soils are on nearly level or gently sloping positions on the landscape. The well drained, sandier Boyer soils are higher on the landscape than the Rawson soil. The moderately well drained, more clayey Glynwood soils are on lower positions. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Rawson soil is moderate. Permeability is moderate in the upper part of the surface layer and subsoil and slow in the lower part and in the underlying material. Surface runoff and the organic matter content are moderate. The water table is at a depth of 2 1/2 to 6 feet during the winter and spring. The surface layer is friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grains. Erosion is the major hazard. Conservation tillage that leaves all or part of the crop residue on the surface, grade stabilization structures, and crop rotation may reduce this hazard.

This soil is well suited to grasses and legumes for hay and pasture. Maintenance of good vegetative cover is effective in controlling erosion. Proper stocking, pasture rotation, and restricted use during wet periods help maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is moderately limited by wetness and shrinking and swelling. Subsurface drains can be installed, however, to help lower the water table. Foundations, footings, and basement walls should be strengthened. Backfilling with a coarser material helps prevent structural damage from shrinking and swelling of the soil. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is moderately limited by frost action. Replacing or covering the upper soil layers with suitable base material reduces damage from frost action.

The use of this soil for septic tank absorption fields is severely limited by wetness and slow permeability. Filling or mounding with a more suitable fill material to raise the absorption field reduces the permeability problem. Drains around the outer edges of the absorption field remove excess water.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

Re—Rensselaer loam. This nearly level, deep, very poorly drained soil is along old drainageways and on terraces and till plains. It is frequently ponded with surface water runoff from adjacent higher lying areas (fig. 9). Areas are irregular or elongated in shape. They range from 8 to 100 acres and average about 40 acres.

In a typical profile, the surface layer is very dark brown loam about 10 inches thick. The mottled subsoil is about 31 inches thick. The upper part is dark gray, friable loam; the next part is dark gray, firm clay loam; and the lower part is gray, firm silty clay loam. The underlying material is grayish brown and dark grayish brown, stratified sandy loam, silty clay loam, loamy sand, and silty clay loam. In places the dark-colored surface layer is less than 10 inches thick. Some areas have an overwash about 10 to 15 inches thick. In some areas as much as 14 inches of

Figure 9.—Surface water ponding on Rensselaer loam.

muck is on the surface, and in other areas less clay is in the surface layer and subsoil. Some areas are underlain with sand and gravelly sand.

Included with this soil in mapping are a few small, slightly convex, higher lying areas of somewhat poorly drained Whitaker soils. Also included are a few small areas of lower lying, mucky Houghton soils and undrained areas of wetter soils. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Rensselaer soil is high. Permeability is slow in the subsoil and moderate in the underlying material. Surface runoff is slow to ponded, and the organic matter content is high. The water table is at or above the surface during the winter and spring. Clods are formed if this soil is plowed when wet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland. Some areas are undrained and are idle.

When adequately drained and properly managed, this soil is well suited to corn, soybeans, and small grains. Ponding is a hazard, and wetness is the main limitation. Excess water can be removed by subsurface drains, open ditches, surface drains, pumping, or a combination of these practices. If stratified material is below a depth of about 41 inches, caving may occur during subsurface drain installation. Conservation tillage that leaves all or part of the crop residue on the surface and winter cover crops improve and help maintain tilth and the organic matter content of the soil.

This soil is well suited to grasses and legumes for hay and pasture. Drainage of this soil is necessary to obtain high yields of forage and pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking, rotational grazing, timely deferment of grazing, and restricted use during wet periods reduce surface compaction and help maintain good tilth and plant density.

This soil is suited to trees. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Harvesting is generally delayed to dry periods or when the ground is frozen. Tree species that can tolerate wet conditions are favored in stands. Harvest methods should be used that do not leave trees standing alone or widely spaced. Seedlings survive and grow well if competing vegetation is controlled by spraying, cutting, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited by ponding. It is generally unsuitable for these uses. The use of this soil for roads is severely limited by ponding, low strength, and frost action. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts protect them from ponding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Se—Sebewa sandy loam. This nearly level, very poorly drained soil is moderately deep over sand and gravel. It is along some streams and in depressions on outwash plains and terraces. It is frequently ponded with surface water runoff from adjacent higher lying areas. Areas are broad and irregular in shape. They range from about 3 to 150 acres but are dominantly about 20 acres.

In a typical profile, the surface layer is black sandy loam about 11 inches thick. The subsoil is about 18 inches thick. The upper part is gray, mottled, firm sandy clay loam, and the lower part is gray, mottled, very friable loamy sand. The underlying material to a depth of 60 inches or more is grayish brown, mottled, stratified, calcareous gravelly coarse sand. In some areas a layer of muck 14 inches or less thick covers the surface. Some areas have less than 10 inches of dark surface soil. Some areas have an overwash about 10 to 17 inches thick. In places gravelly sand and sand are more than 40 inches deep. In some areas the subsoil has more or less clay than typical.

Included with this soil in mapping are some areas of a soil that has a browner subsoil and is in slightly higher, convex areas than the Sebewa soil. Also included are small areas of depressional soils that are wet for extended periods, small areas of lower lying, less sandy Bono soils, and the organic Houghton soils. The well drained Boyer and Oshtemo soils are on higher lying positions. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Sebewa soil is low. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Surface runoff is very slow to ponded, and the organic matter content is high. The water table is at or above the surface during the fall, winter, and spring. The surface layer is friable and easy to work throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grains. Ponding is a hazard, and wetness is the major limitation. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. With drainage and proper management, this soil is suited to intensive row cropping. Conservation tillage that leaves all or part of the crop residue on the surface improves and helps maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. Drainage of this soil is necessary to obtain high yields of forage or pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking and timely grazing reduce surface compaction and maintain good tilth and plant density.

This soil is suited to trees. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Harvesting of trees is generally delayed to dry seasons or when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Seedlings survive and grow well if competing vegetation is controlled. Harvest methods should be used that do not leave trees standing alone or widely spaced. The control or removal of unwanted trees and shrubs can be accomplished by cutting, spraying, or girdling.

The use of this soil for building sites and sanitary facilities is severely limited by ponding. It is generally unsuitable for this use. The use of this soil for roads is severely limited by ponding and frost action. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts protect them from ponding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

SrB2—Strawn loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is on broad, convex slopes on moraines. Areas are broad and irregular in shape and are dominantly about 30 acres.

In a typical profile, the surface layer is about 8 inches thick. It is about 85 percent brown loam and 15 percent dark yellowish brown material. The subsoil is about 15 inches thick. The upper part is dark yellowish brown, firm loam, and the lower part is dark yellowish brown, friable clay loam. The underlying material to a depth of 60 inches or more is yellowish brown and brown loam. In places the subsoil extends to a depth of about 50 inches. Also in places there is more clay in the subsoil. In some areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few low areas of somewhat poorly drained Conover soils. Also included are a few small areas on ridgetops of a soil that has 2 or 3 feet of sand. In some areas slopes are more than 6 percent, and in other small areas the soil is severely eroded. Depressional areas that are wet during most of the year are also included. These inclusions make up about 5 to 15 percent of the unit.

The available water capacity of this Strawn soil is moderate, and permeability is moderate. Surface runoff is medium, and the organic matter content is moderate. The surface has a tendency to crust or puddle after hard rains, especially where the plow layer contains subsoil material.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and a few areas are in woodland.

This soil is well suited to corn, soybeans, and small grains. Erosion is the major hazard. Crop rotation, conservation tillage that leaves all or part of the crop residue on the surface, cover crops, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Returning crop residue to the soil or the regular addition of other organic material helps to reduce crusting and increases water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. These crops are effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods reduce surface compaction and help maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by spraying, cutting, or girdling.

This soil is suited to building sites. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is severely limited by low strength and frost action. It may be necessary to replace layers of the soil that have a moderate shrink-swell potential and cover the surface with suitable base material. The use of this soil for septic tank absorption fields is moderately limited by moderate permeability. This can be overcome by mounding the field or excavating the less permeable material and replacing it with more permeable material.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

SrC2—Strawn loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on dissected parts of moraines. The slopes are generally short. Most areas are irregular in shape, and many are elongated and narrow. They range from about 3 to 40 acres but are dominantly about 12 acres.

In a typical profile, the surface layer is about 7 inches thick. It is about 85 percent brown loam and about 15 percent dark yellowish brown material. The subsoil is dark yellowish brown, firm clay loam about 14 inches thick. The underlying material to a depth of 60 inches or more is brown and yellowish brown loam. In places the subsoil extends to a depth of about 50 inches. In places the subsoil has more clay. In some areas cobbles cover 1 to 2 percent of the surface.

Included with this soil in mapping are a few small low areas of somewhat poorly drained Conover soils and a few small areas on mounds and ridges where the sand is 2 or 3 feet thick. In some included areas slopes are less than 6 percent. There are also a few small areas of severely eroded soils and small depressional areas that are wet most of the year. These inclusions make up about 5 to 10 percent of the unit.

The available water capacity of this Strawn soil is moderate, and permeability is moderate. Surface runoff is medium to rapid, and the organic matter content is moderate. The surface has a tendency to crust and

puddle after hard rains, especially where the plow layer contains subsoil material.

Most areas of this soil are used for cultivated crops. Many areas are used for hay and pasture, and some areas are in woodland.

This soil is suited to corn, soybeans, and small grains. Erosion is a severe hazard. Conservation practices are needed to control erosion where cultivated crops are grown. Crop rotation, conservation tillage that leaves all or part of the crop residue on the surface, grade stabilization structures, grassed waterways, terraces, and farming on the contour help to prevent excess soil loss. The use of crop residue and cover crops also help to control erosion and improve and maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay and pasture. Grasses and legumes are effective in controlling erosion. Grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, girdling, or spraying.

The use of this soil for building sites is moderately limited by slope. Buildings should be designed to complement the slope. Existing vegetation should be disturbed as little as possible during construction, and those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is moderately limited by slope, low strength, and frost action. Constructing roads on the contour and land shaping help to overcome the slope limitation. It may be necessary to replace layers of the soil that have a moderate shrink-swell potential and cover the soil surface with suitable base material.

The use of this soil for septic tank absorption fields is moderately limited by moderate permeability and slope. Increasing the size of the septic tank absorption field or mounding will reduce the permeability problem. Installing the absorption field on the contour offsets the slope limitation.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

StC3—Strawn clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, well drained soil is on dissected parts of till moraines. The slopes are short and dominantly have gradients of about 10 percent. Most areas are irregular in shape, and many are elongated and narrow. They range from about 4 to 35 acres, but are dominantly about 12 acres.

In a typical profile, the surface layer is brown clay loam about 7 inches thick. The subsoil is dark yellowish brown, firm clay loam about 12 inches thick. The calcareous underlying material to a depth of 60 inches or more is yellowish brown loam. In places the subsoil has more clay. In some areas cobbles cover 1 to 5 percent of the surface.

Included with this soil in mapping are a few small depressional areas of somewhat poorly drained Conover soils and some small, higher lying areas of a soil that has 2 or 3 feet of sand. Also included are small areas of a soil that is moderately eroded. There are some small areas where slopes are less than 6 percent or more than 12 percent. Also included are a few small areas of a moderately eroded soil that has 15 to 25 percent gravel in the surface layer. These inclusions make up about 3 to 10 percent of the unit.

The available water capacity of this Strawn soil is moderate, and permeability is moderate. Surface runoff is medium to rapid, and the organic matter content is low. The surface layer has a tendency to become compact and form clods if tilled when wet.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and a few areas are in woodland.

This soil is poorly suited to corn, soybeans, and small grains. Erosion is a severe hazard. Conservation practices are needed to control erosion and surface water runoff when crops are grown. This soil is suited to occasional, but not regular, cultivation. Crop rotation, conservation tillage that leaves all or part of the crop residue on the surface, grade stabilization structures, grassed waterways, and farming on the contour help prevent excessive soil loss. The use of crop residue and cover crops also help to control erosion and improve and maintain tilth and the organic matter content of this soil.

This soil is well suited to grasses and legumes for hay or pasture. A continuous ground cover helps control erosion of the surface. Overgrazing may cause excessive runoff and poor tilth. Proper stocking, pasture rotation, and restricted use during wet periods reduce surface compaction and help maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well when competing vegetation is controlled by cutting, girdling, or spraying.

The use of this soil for building sites is moderately limited by slope. Buildings should be designed to complement the slope. Existing vegetation should be disturbed as little as possible during construction, but those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for local roads and streets is moderately limited by slope, low strength, and frost action. Constructing local roads on the contour and using land shaping helps to overcome the slope limitation. It may be necessary to replace layers of the soil that have a moderate shrink-

swell potential and cover the soil surface with suitable base material to offset the low strength and frost action.

The use of this soil for septic tank absorption fields is moderately limited by moderate permeability and slope. Increasing the size of the absorption field or mounding reduces the permeability problem. Installing the absorption field on the contour helps to overcome the slope limitation.

This soil is in capability subclass IVe and woodland suitability subclass 2o.

StD3—Strawn clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, deep, well drained soil is on dissected parts of moraines. The slopes are short and generally convex. Most areas are irregular in shape and many are elongated. They are dominantly about 8 acres.

In a typical profile, the surface layer is brown clay loam about 6 inches thick. The subsoil is dark yellowish brown, firm clay loam about 10 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown loam. In places the subsoil has more clay. In some areas cobbles cover 1 to 5 percent of the surface.

Included with this soil in mapping are small areas of a soil that is moderately eroded. Also included are small areas where slope is less than 12 percent or more than 18 percent. Also included are a few small depressional areas of the somewhat poorly drained Conover soils. These inclusions make up about 3 to 8 percent of the unit.

The available water capacity of this Strawn soil is moderate, and permeability is moderate. Surface runoff is rapid, and the organic matter content is low. If the surface layer is tilled when it is too wet, it has a tendency to become compact and form clods.

Most areas of this soil are used for hay or pasture. Some areas are used for cultivated crops, and some areas are in woodland.

This soil is generally unsuitable for corn, soybeans, and small grains because of the severe hazard of erosion. The steepness of the slope makes it difficult to use most standard farm machinery.

This soil is suited to grasses and legumes for hay or pasture. Continuous ground cover helps control erosion of the surface. Overgrazing may cause excessive runoff, compaction, and poor tilth. Proper stocking and pasture rotation reduce surface compaction and maintain good tilth and plant density.

This soil is suited to trees. Erosion hazard, equipment limitation, seedling mortality, and plant competition are the main management concerns. Proper management of ground cover, placing logging roads on the contour, and timely use of equipment when the topsoil is dry and firm reduce soil erosion. Seedlings survive and grow well when competing vegetation is controlled by cutting, girdling, or spraying.

The use of this soil for building sites is severely limited by slope. Buildings should be designed to complement slope. Land shaping and installing retaining walls also help to overcome this limitation. Existing vegetation should be disturbed as little as possible during construction, but those areas that are disturbed should be revegetated as soon as possible to reduce erosion. The use of this soil for roads is severely limited by slope. Cutting and filling may be needed, and roads should be built on the contour where possible. The use of this soil for septic tank absorption fields is severely limited by slope. Installing the absorption field on the contour helps to overcome the limitation.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

Ud—Udorthents, loamy. This soil is nearly level to moderately sloping, deep, and somewhat poorly drained to well drained. It is in disturbed areas of the uplands and on terraces, mainly sanitary landfills and areas where building and road construction have taken place. In places, deep cuts have been made in the original soil and the excavated material has been used to fill in lower lying areas and provide a smoother, more level landscape. In other areas, the removed material has been used as fill for highway grades, overpasses, exit ramps, and gravel pits. Areas range from about 5 to 60 acres.

A typical area of Udorthents is a mixture of surface soil, subsoil, and underlying material. It is silt loam, loam, silty clay loam, or clay loam that may contain some sand and gravel, shale, cobbles, or stones. It is slightly acid to moderately alkaline. In a typical area where a deep cut has been made, the material is mainly silty clay loam or clay loam glacial till.

Included with this soil in mapping are small areas of a soil that has short, steep slopes and areas of sand and gravel. Highways and highway interchanges also cover some areas. Also included are areas where slopes are 12 to 18 percent and some places that are underlain by muck. These inclusions make up about 2 to 15 percent of the unit.

The available water capacity of this soil is low to high, and permeability is slow to moderate. The organic matter content of the surface layer is low to moderate.

Most areas of this soil are in permanent grass, legumes, or low-growing shrubs because of limited access. Many areas are surrounded by heavily traveled highways. Special management practices are needed in some areas of this soil. An intensified fertilization program with special emphasis on incorporating organic residue or manure into the soil is necessary if these areas are to be used for crops. Conservation practices are needed to control erosion in the gently sloping and moderately sloping areas. Diversions, box-inlet structures, and grassed waterways are conservation practices that can be used. Drainage may be needed in

the nearly level areas. Exposed areas should be revegetated as soon as possible after construction.

An onsite investigation is needed if this soil is to be used for building sites. The depth to the water table and its relation to frost action potential should be considered. Because the soil properties significant to the design of a structure vary from one location to another, engineering test data should be collected. If this soil is used as a building site, minimum removal of vegetation is suggested, and protective plant cover should be established as quickly as possible to hold erosion losses to a minimum. Nearly level areas may need drainage. The limitations of this soil for septic tank absorption fields are variable. Attention should be given to wetness and permeability in nearly level areas and to slope and permeability in gently sloping and moderately sloping areas. Onsite investigation is needed.

This map unit is not assigned to a capability subclass or woodland suitability subclass.

Wa—Wallkill silt loam. This nearly level, deep, very poorly drained soil is in small depressions on uplands and outwash drainageways. These areas are frequently ponded by runoff from adjacent areas. Areas are dominantly oval or elongated in shape. They range from about 2 to 40 acres but are dominantly about 5 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The underlying material, to a depth of about 20 inches, is dark grayish brown, mottled, friable silt loam. Below this to a depth of 60 inches or more is black muck. In places the mineral layer has more clay. In some places the underlying material is marl or sedimentary peat or includes stratified layers of mineral soil material.

Included with this soil in mapping are small areas of deep mineral Bono, Pewamo, Rensselaer, and Sebewa soils which are on slightly higher positions than the Wallkill soil. These inclusions make up 5 to 12 percent of the unit.

The available water capacity of this Wallkill soil is very high. Permeability is moderate in the mineral surface and subsoil layers and moderately rapid in the organic material. Surface runoff is slow, and the organic matter content is high. The water table is at or above the surface during the fall, winter, and spring. If this soil is tilled when wet, the surface layer becomes cloddy.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

Most areas of this soil have been drained and are suited to corn, soybeans, and small grains. Wetness is the major limitation. Subsurface drains and open ditches or a combination of these will lower the water table and reduce the time period of ponding. Drainage, however, will not prevent ponding. Conservation tillage that leaves all or part of the crop residue on the surface improves and maintains tilth and the organic matter content of the soil.

This soil is suited to grasses and legumes for hay or pasture. Shallow-rooted legumes should be favored since deep-rooted legumes like alfalfa are generally unsuitable. This soil is susceptible to ponding and a high water table. Drainage of this soil is necessary to obtain high yields of forage or pasture. Drainage lowers the water table and may reduce the time period of ponding. Overgrazing also reduces plant density and hardiness. Proper stocking, timely grazing, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

This soil is poorly suited to trees. Restricted use of equipment, seedling mortality, windthrow hazard, and plant competition are the main management concerns. Use of heavy logging equipment may cause excessive compaction of this soil. Harvesting of trees is usually delayed to dry seasons or when the ground is frozen. Harvesting methods should be used that do not leave trees standing alone or widely spaced. Competing vegetation can be controlled by spraying, cutting, or girdling. Tree species which are water tolerant should be favored in stands.

The use of this soil for building sites and sanitary facilities is severely limited by ponding and wetness. This soil is generally unsuitable for these uses. The use of this soil for roads is severely limited by ponding, low strength, and frost action. It may be necessary to replace the organic layers of the soil with suitable soil material to overcome the low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts protect them from ponding and frost damage.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Wt—Whitaker silt loam. This nearly level, deep, somewhat poorly drained soil is on outwash terraces. Areas are elongated or broad and irregular in shape. They range from about 4 to 30 acres but are dominantly about 8 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 2 inches thick. The subsoil is about 45 inches thick. It is yellowish brown, mottled, friable loam and silty clay loam in the upper part and gray, mottled, friable silt loam with strata of silt loam, very fine sand, fine sandy loam, and clay loam in the lower part. The underlying material to a depth of 60 inches or more is stratified. It is gray, mottled silt loam with strata of very fine sand, fine sandy loam, loamy sand, and clay loam. In places the underlying material is sand or sand and gravel.

Included with this soil in mapping are a few small areas of very poorly drained Rensselaer soils which are lower on the landscape than the Whitaker soil. Also included are a few small areas of higher lying, less stratified Blount soils which have more clay in the profile

and a few small areas of higher lying, more clayey Haskins soils. These inclusions make up about 5 to 12 percent of the unit.

The available water capacity of this Whitaker soil is high, and permeability is moderate. Surface runoff is slow, and the organic matter content is moderate. The water table is at a depth of 1 foot to 3 feet during the winter and spring. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture or are in woodland.

This soil is suited to corn, soybeans, and small grains. Wetness is the main limitation. The use of subsurface drains and open ditches help overcome the wetness concern. Conservation tillage that leaves all or part of the crop residue on the surface helps to maintain the organic matter content and good tilth of this soil.

This soil is well suited to grasses and legumes for hay or pasture. Drainage is generally beneficial. Deep-rooted legumes, such as alfalfa, are not as well suited as shallow-rooted crops. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking, pasture rotation, and restricted use during wet periods reduce surface compaction and maintain good tilth and plant density.

This soil is suited to trees. Plant competition is the main management concern. Seedlings survive and grow well when competing vegetation is controlled by cutting, spraying, or girdling.

The use of this soil for building sites is severely limited by wetness. Subsurface drains can be installed, however, to lower the water table. Foundations, footings, and basement walls should be strengthened and backfilled with a coarser material to help prevent structural damage caused by shrinking and swelling. The use of this soil for local roads and streets is severely limited by low strength and frost action. Providing adequate drainage along roads reduces possible damage from frost action. The base material will need replacing or strengthening with a more suitable material to support vehicular traffic.

The use of this soil for septic tank absorption fields is severely limited by wetness and moderate permeability. Filling or mounding with a more suitable fill material and elevating the absorption field reduce the wetness problem. Drains around the outer edges of the absorption field remove excess water.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

prime farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cropland, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber or is available for these uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland may be used for crops, pasture, woodland, or similar purposes, but not for urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland receives an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at local offices of the Soil Conservation Service.

In DeKalb County about 47,000 acres, or about 20 percent of the total acreage, meet the requirements of prime farmland. An additional 142,000 acres meet the requirements only where drained. Prime farmland occurs in scattered areas throughout the county. Nearly all of the areas considered prime farmland are used for corn and soybeans.

In some parts of the county, prime farmland has been lost to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which are then cultivated although they generally are more erodible, droughty, or difficult to cultivate and less productive.

The map units that meet the soil requirements for prime farmland in DeKalb County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps at the back of this publication. The

soil qualities that affect use and management are described in the section "Detailed soil map units."

Soils that have limitations—a high water table, flooding, or inadequate rainfall—may qualify for prime farmland if these limitations are overcome by such measures as drainage, flood control, or irrigation. In the following list, the measures used to overcome these limitations are shown in parentheses after the map unit name. Onsite evaluation is necessary to see if these limitations have been overcome by corrective measures.

The map units that meet the requirements for prime farmland are:

BaA	Blount silt loam, 0 to 2 percent slopes (where drained)
BaB2	Blount silt loam, 1 to 4 percent slopes, eroded (where drained)
Bn	Bono silty clay (where drained)
CrA	Conover loam, 0 to 3 percent slopes (where drained)
GnB2	Glynwood loam, 3 to 6 percent slopes, eroded
HaA	Haskins loam, 0 to 3 percent slopes (where drained)
MfB	Metea loamy sand, 2 to 6 percent slopes
OhB	Oshtemo sandy loam, 0 to 6 percent slopes
Pe	Pewamo silty clay (where drained)
RaB	Rawson sandy loam, 2 to 6 percent slopes
Re	Rensselaer loam (where drained)
Se	Sebewa sandy loam (where drained)
SrB2	Strawn loam, 2 to 6 percent slopes, eroded
Wt	Whitaker silt loam (where drained)

crops and pasture

Bruce A. Julian, district conservationist, Soil Conservation Service, assisted in the preparation of this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 171,498 acres in the survey area were used for crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this total 18,479 acres were used for permanent pasture; 79,093 acres for row crops, mainly corn and soybeans; 34,182 acres for close-grown crops, mainly winter wheat and oats; and 18,083 acres for rotation hay and pasture. The rest was idle cropland and used for conservation purposes.

The potential of the soils in DeKalb County for increased production of food is good. About 4,400 acres of potentially good cropland is currently used as woodland and about 5,200 acres as pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Acreage in crops and pasture has been decreasing gradually as more and more land is used for urban development. It was estimated that in 1967 there were about 6,758 acres of urban and built-up land in the county; this figure has been growing at the rate of about 1,300 acres per year. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map units."

Soil drainage is the major problem on about 35 percent of the cropland and pasture in DeKalb County. Most areas of the very poorly drained Pewamo, Sebewa, and Rensselaer soils are satisfactorily drained for agricultural production. A few areas of these soils, however, cannot be drained economically because they are depressional. Drainage ditches would have to be deep and extend for great distances to a suitable outlet. This condition exists for some areas of Houghton soils that are not satisfactorily drained. Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. In this category are Conover, Whitaker, and Blount soils, which total about 80,094 acres.

Strawn and Morley soils have good natural drainage most of the year, but they tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included in mapping these soils, especially the Strawn soils that have slopes of 2 to 6 percent. Artificial drainage is needed in some of these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of the very poorly drained soils used for intensive row cropping. Drains have to be more closely spaced in soils with slow permeability than in soils that are more permeable. Subsurface drainage is slow in the Pewamo soils, and finding adequate outlets is difficult in many areas of Pewamo and Houghton soils.

Organic soils oxidize and subside when the pore space is filled with air; therefore, special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils. Information on

drainage design for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil erosion is the major soil problem on about 60 percent of the cropland and pasture in DeKalb County. If the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as the Blount and Morley soils. Erosion also reduces productivity on soils that tend to be droughty, such as the Boyer and Oshtemo soils. Second, soil erosion results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult on clayey spots because the original friable surface soil has been eroded away. Such spots are common in areas of moderately and severely eroded Strawn and Morley soils.

Erosion control practices provide surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop.

Slopes are so short and irregular that contour tillage or terracing is not practical on sloping soils in most of DeKalb County. On these soils, cropping systems that provide substantial vegetative cover are required to control erosion unless conservation tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area but are more difficult to use successfully on the eroded soils and on the soils that have a clayey surface layer, such as the Pewamo and Bono soils.

Diversions and parallel subsurface drain outlet terraces are used to shorten the effective length of slope and are effective in reducing sheet, rill, and gully erosion. They are most practical on deep, well drained soils that are highly susceptible to erosion. Terracing reduces soil loss and the associated loss of fertilizer elements; reduces damage to crops and watercourses from sedimentation; reduces the need for grassed waterways, which take productive land out of row crops; and makes it easier to farm on the contour, which reduces the use of fuel and reduces the amount of pesticides entering watercourses. Many of the Strawn soils are suitable for terraces. Soils which have a heavy clayey subsoil are less suitable for terraces and diversions but can be adapted to these uses.

Grassed waterways are needed in many areas of DeKalb County, such as the sloping Strawn and Morley soils and the Conover and Pewamo soils that have a large watershed draining across them. Subsurface drains generally need to be installed below the waterways in the Conover and Pewamo soils and in many seepy areas of the Strawn soil along drainageways.

Because of the large number of open ditches in the county, many grade stabilization structures are needed. These structures reduce erosion where surface water drains into an open ditch. They are also needed where there is too much grade and the water moves so rapidly that it erodes the sides and bottom of the ditch.

Soil blowing is a hazard on Houghton soils when they are drained. Soil blowing can damage these muck soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. It can be minimized by maintaining vegetative cover, mulching the surface or leaving it rough through proper tillage, and using a planned water management system. Windbreaks of adapted shrubs are effective in reducing wind erosion on the muck soils. Soil blowing also occurs on the dark-colored mineral soils when they are barren. Soils that are plowed in the fall are very susceptible to wind erosion the following spring.

Soil fertility is naturally low or moderate in most soils of the uplands and terraces. The soils on flood plains, such as Landes and Eel soils, are neutral or mildly alkaline and are naturally higher in plant nutrients than most upland and terrace soils. The very poorly drained Pewamo and Houghton soils are in slight depressions and receive runoff from adjacent upland soils. They normally are slightly acid or neutral and are naturally high in fertility.

Strongly acid or medium acid soils need ground limestone to raise the pH level for good growth of alfalfa and other crops that grow only on nearly neutral soils. Available phosphorus and potash levels are naturally low on most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Many of the soils used for crops in the survey area have a silt loam or loam surface layer that is dark in color and moderate in content of organic matter. Generally the structure of these soils is moderate to weak, and intense rainfall causes the formation of some crust on the surface. The crust in some areas is hard when dry and impervious to water. Once a hard crust forms, infiltration is reduced and runoff is increased.

Regular additions of crop residue, manure, and other organic material can help improve soil structure and reduce crust formation.

Fall plowing is not a good practice on the light-colored soils that have a silt loam or loam surface layer. A crust forms on these soils during the winter and spring leaving them nearly as dense and hard at planting time as they were before fall plowing. Also, about 50 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall.

Tilth is a problem on the dark-colored, clayey Pewamo soils that often stay wet until late in the spring. If plowed when wet, these soils tend to be very cloddy when dry and good seedbeds are difficult to prepare.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn and soybeans are the main row crops. Winter wheat and oats are the common close-growing crops. Rye could be grown, and grass seed could be produced from bromegrass, fescue, redtop, and clover.

Special crops are of limited commercial importance in the survey area. Only a small acreage is used for vegetables and small fruits. Deep soils that have good natural drainage and that warm up early in the spring are especially well suited to many vegetables and small fruits. These are the Oshtemo, Boyer, and Ormas soils that have slopes of less than 6 percent, and they total about 9,961 acres. These soils need irrigation for optimum production. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area.

When adequately drained, the muck soils in the county are well suited to a wide range of vegetable crops. Houghton muck soils make up about 7,850 acres in the survey area.

Most of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Larry L. Lichtsinn, district forester, Indiana Department of Natural Resources assisted in writing this section.

Most of Dekalb County was originally covered with dense hardwood forest. (The term "hardwood" refers to broadleaved trees; "softwoods" have needles or scalelike leaves.) Depressional areas and borders of natural lakes contained stands of tamarack (eastern larch), which is a softwood. Artificial drainage for cropland production has made the tamarack a rare tree species in Dekalb County.

According to the Conservation Needs Inventory of 1968 (*3*), about 10 percent of the total land area, or 24,442 acres, was in woodland at that time. This figure has been reduced considerably since then because of urbanization and land clearing for cropland and utility right-of-ways.

Most of the existing woodlots are on rolling terrain or along natural drainageways, although small tracts are in nearly level, poorly drained areas. With some exceptions, most individual woodlots are smaller than 20 acres.

The major forest type in the county is oak-hickory. It consists mainly of hickory, white oak, and red oak in association with ash, basswood, sugar maple, walnut, cherry, bur oak, swamp white oak, black oak, soft maple, and beech. The oak-hickory forest type is found over most of the county, with the exception of the northwest quarter and areas bordering depressions and natural drainageways and lakes. Morley and Blount soils are associated with this forest type.

The northwestern quarter of the county generally supports trees of the beech-maple forest type. The major species of this forest type are sugar maple and beech in association with ash, basswood, cherry, red oak, walnut, and hickory. Strawn and Morley soils are associated with this forest type.

Natural drainageways, flood plains, and areas surrounding natural lakes and depressions produce mostly bottomland hardwoods. Major species are soft maple, cottonwood, sycamore, and ash in association with basswood, elm, hickory, hackberry, swamp white oak, and bur oak. The level or nearly level, poorly drained Blount, Pewamo, and Sebewa soils are associated with this forest type.

Important tree species in DeKalb County for producing veneer, grade lumber, and crating are sugar maple, beech, red oak, white oak, walnut, ash, basswood, hickory, and soft maple.

Important factors that affect the capacity of the soil to grow trees are the texture, permeability, available moisture capacity, rate of runoff, and depth of the water table.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *w* indicates excessive water in or on the soil; *s*, sandy texture; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: w, s, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes

and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Alger F. VanHoey, district wildlife biologist, Indiana Department of Natural Resources assisted in the preparation of this section.

Wildlife habitat is made up of three major components; food, cover, and water. Wildlife management programs seek to manipulate these components to make an area more attractive to wildlife. The kind and abundance of wildlife that populate a region depend largely on the amount and distribution of the above factors. If any one of them is missing, inadequate, or inaccessible, then wildlife are either scarce or absent from the area.

Changing land use in DeKalb County affects the amount and type of habitat available to wildlife. As these habitat changes occur, so do changes in the numbers and species of wildlife that inhabit the area. By increasing the quality, quantity, and interspersion of the vegetative types and elements comprising wildlife habitat, an area can be greatly improved for wildlife.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, wheat, oats, and sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, bluegrass, timothy, bromegrass, clover, lespedeza, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, ragweed, foxtail, goldenrod, beggarweed, and wheatgrass.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil

properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, maple, beech, poplar, wildcherry, honeysuckle, sumac, raspberry, viburnums, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, crabapple, and Washington hawthorn.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are cattail, water-plantain, arrowhead, smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, swamps, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, mourning dove, killdeer, woodchuck, quail, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include opossum, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfisher, muskrat, mink, and beaver.

Edge habitat is that which grows where one major land use cover ends and another begins. Although it is not rated in the table, it is of prime importance for both birds and mammals ranging from the smallest songbird to Indiana's largest game, the white-tailed deer. Most of the plants and animals that inhabit both open land and woodland also use edge habitat. Desirable edge habitat is consistently used by ten times more wildlife than are the centers of large fields of either woodland or cropland. A good example of edge habitat occurs where the outside edge of a thick woodland parallels the outside edge of a no-till field of corn.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology;

(6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding or ponding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect

absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 foot to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, or organic matter. A high water

table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table and permeability of the aquifer. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops.

They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that

delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture and acidity.

engineering test data

Table 19 shows laboratory test data for two pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by Indiana State Highway Research and Training Center, Purdue University.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sols*. An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, illitic, mesic, Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*5*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Blount series

The Blount series consists of deep, somewhat poorly drained, slowly permeable soils on till plains and moraines. They formed in glacial till. Slopes range from 0 to 4 percent.

Blount soils are commonly adjacent to Glynwood, Haskins, Morley, Pewamo, and Rawson soils. Glynwood and Morley soils are better drained and are on higher lying positions on the landscape than Blount soils. Haskins and Rawson soils have less clay and more sand in the upper 20 to 40 inches of the solum, and Rawson soils are on higher lying positions on the landscape.

Pewamo soils have a thicker, darker surface layer and are in depressions.

Typical pedon of Blount silt loam, 0 to 2 percent slopes, in a cultivated field, 225 feet south and 900 feet west of the northeast corner of sec. 25, T. 33 N., R. 14 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate coarse granular structure; friable; common fine roots; 2 percent gravel; slightly acid; abrupt smooth boundary.

B21tg—9 to 16 inches; grayish brown (10YR 5/2) clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 2 percent gravel; very strongly acid; clear wavy boundary.

B22t—16 to 25 inches; dark yellowish brown (10YR 4/4) clay; common fine distinct gray (10YR 5/1) mottles; moderate medium angular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 2 percent gravel; slightly acid; clear wavy boundary.

B3t—25 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; common faint gray (10YR 6/1) carbonate coatings on faces of peds; 2 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C—35 to 60 inches; brown (10YR 4/3) silty clay loam; few fine distinct gray (10YR 5/1) mottles; massive; firm; many faint gray (10YR 6/1) carbonate coatings on faces of peds; 3 percent gravel; slight effervescence; mildly alkaline.

The solum is 22 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. It is silt loam or loam. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4 and is distinctly mottled. It is silty clay loam, clay loam, silty clay, or clay and is very strongly acid to slightly acid. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam or clay loam and is mildly alkaline or moderately alkaline.

Bono series

The Bono series consists of deep, very poorly drained, slowly permeable soils that formed in lacustrine sediments on glacial till plains. These soils have less clay in the C horizon than is defined as the range for the Bono series. Also, the organic carbon content in the lower part of the soil is variable. These differences do not alter the use or behavior of the soil. Slopes range from 0 to 2 percent.

Bono soils are similar to the Pewamo soils and are commonly adjacent to the Blount, Houghton, Morley, and Pewamo soils. Pewamo soils formed in glacial till. Blount and Morley soils are better drained and are on higher positions on the landscape than Bono soils. Houghton soils consist of organic materials throughout.

Typical pedon of Bono silty clay, in a cultivated field, 400 feet west and 1,780 feet north of the southeast corner of sec. 27, T. 34 N., R. 12 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; weak coarse granular structure; friable; many fine and few medium roots; neutral; abrupt smooth boundary.

B1tg—10 to 16 inches; gray (10YR 5/1) silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; thin discontinuous gray (10YR 5/1) coatings on faces of peds; neutral; gradual wavy boundary.

B21tg—16 to 28 inches; dark gray (10YR 4/1) silty clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; few discontinuous dark grayish brown (10YR 4/2) coatings on the faces of peds; neutral; gradual wavy boundary.

B22tg—28 to 44 inches; dark gray (5Y 4/1) clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) coatings; neutral; clear wavy boundary.

B23tg—44 to 48 inches; dark gray (5Y 4/1) clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; thin discontinuous very dark grayish brown (2.5Y 3/2) coatings on the faces of peds; neutral; abrupt wavy boundary.

B24tg—48 to 58 inches; dark gray (5Y 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; thin discontinuous very dark grayish brown (2.5Y 3/2) coatings on the faces of peds; neutral; abrupt wavy boundary.

Cg—58 to 60 inches; dark gray (5Y 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum is 36 to 60 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 and hue of 10YR, value of 4 or 5, and chroma of 1 or 2 dry. It is silty clay loam or silty clay. The B2g horizon has hue of 10YR and 5Y, value of 4 or 5, and chroma of 1

and is distinctly mottled. It is silty clay, clay, or silty clay loam. In most places the Cg horizon is silty clay loam, but it often contains thin layers ranging in texture from sandy loam to clay.

Boyer series

The Boyer series consists of well drained soils that are moderately deep over sand and gravel on outwash plains, terraces, and moraines. Permeability is moderately rapid in the solum and very rapid in the underlying material. These soils formed in glacial outwash. Slopes range from 0 to 12 percent.

Boyer soils are similar to Ormas and Oshtemo soils and are commonly adjacent to Metea, Morley, and Sebewa soils on the landscape. Ormas soils have more sand in the surface and subsurface layers than Boyer soils. Oshtemo soils have a thicker solum. Metea soils are underlain by glacial till. Morley soils contain more clay and less sand and are on higher lying positions on the landscape. Sebewa soils are gray in the subsoil, contain more clay in the subsoil, and are in low-lying positions.

A typical pedon of Boyer sandy loam, 0 to 6 percent slopes, in a cultivated field, 2,800 feet north and 2,125 feet east of the southwest corner of sec. 7, T. 33 N., R. 13 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; few fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

B21t—10 to 18 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; few thin clay films; 10 percent gravel; slightly acid; clear wavy boundary.

B22t—18 to 28 inches; reddish brown (5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; friable; few fine roots; few thin clay films; 27 percent gravel; slightly acid; clear wavy boundary.

B23t—28 to 31 inches; reddish brown (5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; friable; few fine roots; few thin clay films; 27 percent gravel; neutral; clear irregular boundary.

IIC—31 to 60 inches; pale brown (10YR 6/3) gravelly coarse sand; single grain; loose; 35 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 and 3 and hue of 10YR, value of 6 or 7, and chroma of 2 or 3 dry. It is loamy sand or sandy loam and medium acid to neutral. The B2t horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 to 6. It is sandy loam, sandy clay loam, loam, or gravelly analogs of these textures. It is medium acid to neutral. The IIC horizon is stratified. Textures are sand, gravelly coarse sand, and very gravelly coarse sand.

Conover series

The Conover series consists of deep, somewhat poorly drained, moderately slowly permeable soils on moraines. They formed in glacial till. Slopes range from 0 to 3 percent.

Conover soils are commonly adjacent to Strawn and Rensselaer soils on tne landscape. Strawn soils are better drained and are higher on the landscape than Conover soils. Rensselaer soils have a gray subsoil and are in depressional areas.

Typical pedon of Conover loam, 0 to 3 percent slopes, in a cultivated field, 1,300 feet west and 780 feet north of the southeast corner of sec. 21, T. 35 N., R. 12 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; many fine roots; 4 percent gravel; medium acid; abrupt smooth boundary.

B21tg—9 to 13 inches; dark grayish brown (10YR 4/2) clay loam; few fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; few fine roots; thin continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; 2 percent gravel; slightly acid; clear wavy boundary.

B22t—13 to 22 inches; dark yellowish brown (10YR 4/4) loam; common fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 4 percent gravel; neutral; clear wavy boundary.

B3t—22 to 28 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; 5 percent gravel; neutral; gradual wavy boundary.

C—28 to 60 inches; brown (10YR 5/3) loam; massive; friable; few distinct gray (10YR 6/1) carbonate coatings on internal planes; 10 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The A horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is loam or silt loam. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4, and is distinctly mottled. It is loam, silty clay loam, or clay loam and is medium acid to neutral. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

Eel series

The Eel series consists of deep, moderately well drained, moderately permeable soils on bottom lands. They formed in alluvium. Slopes range from 0 to 2 percent.

Eel soils are commonly adjacent to Landes soils on the landscape. Landes soils contain more sand and less clay and are slightly higher on the landscape than Eel soils.

Typical pedon of Eel loam, frequently flooded, in a cultivated field, 450 feet north and 800 feet east of the southwest corner of sec. 15, T. 34 N., R. 13 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

C1—9 to 16 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common fine roots; few very dark grayish brown (2.5Y 3/2) iron and manganese oxide accumulations; slightly acid; clear wavy boundary.

C2—16 to 27 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine roots; few very dark grayish brown (2.5Y 3/2) iron and manganese oxide accumulations; neutral; clear wavy boundary.

C3—27 to 39 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few fine roots; few very dark grayish brown (2.5Y 3/2) iron and manganese oxide accumulations; neutral; clear wavy boundary.

C4—39 to 52 inches; yellowish brown (10YR 5/4) clay loam; many fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few very dark grayish brown (2.5Y 3/2) iron and manganese oxide accumulations; neutral; clear wavy boundary.

C5—52 to 60 inches; very dark gray (5Y 3/1) fine.sandy loam; few fine and medium prominent brownish yellow (10YR 6/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is loam and occasionally silty clay loam or silt loam. The C horizon has hue of 10YR or 5Y, value of 3 to 5, and chroma of 1 to 4 and is distinctly mottled in the lower part. It is stratified. Texture, to a depth of 40 inches, is loam and silt loam and thin subhorizons of silty clay loam, clay loam, and sandy loam. The C horizon is slightly acid to mildly alkaline.

Glynwood series

The Glynwood series consists of deep, moderately well drained, slowly permeable soils on till plains and moraines. They formed in glacial till. Slopes range from 3 to 6 percent.

Glynwood soils are similar and adjacent to Morley soils and are adjacent to Blount, Rawson, and Pewamo soils. Morley soils do not have mottles of low chroma in the upper part of the subsoil and are higher on the landscape than Glynwood soils. Blount soils have gray horizons in the subsoil and are on slightly lower positions on the landscape. Rawson soils have less clay in the upper subsoil. Pewamo soils are predominantly gray in the subsoil and are on lower positions on the landscape.

Typical pedon of Glynwood loam, 3 to 6 percent slopes, eroded, in a cultivated field, 2,960 feet east and 1,520 feet south of the northwest corner of sec. 20, T. 34 N., R. 15 E.

Ap—0 to 9 inches; brown (10YR 4/3) loam, very pale brown (10YR 7/3) dry; weak coarse granular structure; friable; few fine roots; 15 percent dark yellowish brown (10YR 4/4) silty clay loam; 5 percent gravel; neutral; abrupt smooth boundary.

B21t—9 to 14 inches; dark yellowish brown (10YR 4/4) clay; moderate medium subangular blocky structure; firm; thin continuous brown (10YR 4/3) clay films on faces of peds; common distinct very dark gray (10YR 3/1) iron and manganese oxide stains and accumulations; 5 percent gravel; neutral; clear wavy boundary.

B22t—14 to 21 inches; dark yellowish brown (10YR 4/4) clay; few fine distinct dark grayish brown (10YR 4/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; thin continuous dark brown (10YR 3/3) clay films on faces of peds; 5 percent gravel; neutral; clear wavy boundary.

B3t—21 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate coarse angular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; few distinct light gray (10YR 7/1) carbonate coatings on faces of peds; 5 percent gravel; strong effervescense; moderately alkaline; clear wavy boundary.

C—28 to 60 inches; brown (10YR 4/3) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; many distinct light gray (10YR 7/1) carbonate coatings on internal planes; 5 percent gravel; strong effervescense; moderately alkaline.

The solum is 18 to 30 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or loam. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6 and is distinctly mottled in the lower part. It is silty clay, silty clay loam, clay, or clay loam. The B2t horizon is medium acid to neutral. The B3 and C horizons have hue of 10YR, value

of 4 or 5, and chroma of 3 or 4 and are silty clay loam or clay loam.

Haskins series

The Haskins series consists of deep, somewhat poorly drained soils on glacial moraines and terraces. Permeability is moderate in the subsoil and slow in the underlying material. These soils formed in loamy, water-sorted materials over glacial till. Slopes range from 0 to 3 percent. These soils have less clay in the lower part of the solum and the underlying material than is defined as the range for the Haskins series. These differences do not alter the use or behavior of the soil.

Haskins soils are commonly adjacent to the Blount, Glynwood, Metea, Pewamo, and Rawson soils. Blount soils have more clay in the upper part of the solum than the Haskins soils. Glynwood soils have more clay in the upper part of the solum and are in higher lying areas. Metea soils have more sand in the surface and subsurface layers. Pewamo soils have a thick, dark surface layer and are in depressional areas. Rawson soils are in higher lying areas and are better drained.

Typical pedon of Haskins loam, 0 to 3 percent slopes, in a cultivated field, 1,500 feet east and 1,700 feet south of the northwest corner of sec. 32, T. 33 N., R. 15 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many medium roots; 2 percent gravel; slightly acid; abrupt smooth boundary.

B1g—9 to 12 inches; grayish brown (10YR 5/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; 2 percent gravel; neutral; clear wavy boundary.

B21tg—12 to 21 inches; grayish brown (10YR 5/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 4 percent gravel; neutral; gradual wavy boundary.

B22t—21 to 24 inches; yellowish brown (10YR 5/4) sandy clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

B23tg—24 to 28 inches; dark grayish brown (10YR 4/2) sandy loam; many medium faint brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; few fine roots; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 2 percent gravel; neutral; abrupt wavy boundary.

IIB3t—28 to 31 inches; brown (10YR 5/3) clay loam; common fine distinct gray (5Y 6/1) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; thin continuous gray (10YR 6/1) clay films on faces of peds; carbonate coatings on faces of peds; 3 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC1—31 to 38 inches; brown (10YR 5/3) clay loam; common fine distinct gray (5Y 6/1) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; firm; thin discontinuous gray (10YR 5/1) clay films on faces of peds; common faint gray (10YR 6/1) carbonate coatings on faces of peds; 2 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2—38 to 60 inches; brown (10YR 5/3) clay loam; massive; firm; 3 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 45 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam or fine sandy loam. It is slightly acid or neutral. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4 and is distinctly mottled. It is loam, clay loam, sandy loam, and sandy clay loam or gravelly analogs of these textures. The B2t horizon is slightly acid to neutral. The IIB3 and IIC horizons are clay loam or silty clay loam.

Hillsdale series

The Hillsdale series consists of deep, well drained, moderately rapidly permeable soils on glacial moraines. They formed in glacial till. Slopes range from 2 to 10 percent.

Hillsdale soils are similar to the Oshtemo soils and are commonly adjacent to Conover soils. The Oshtemo soils are underlain by sand and gravel. The Conover soils are mottled in the subsoil, have more clay in the subsoil, and are lower on the landscape than Hillsdale soils.

Typical pedon of Hillsdale fine sandy loam, 2 to 10 percent slopes, in a cultivated field, 1,880 feet east and 2,880 feet north of the southwest corner of sec. 6, T. 35 N., R. 12 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak coarse granular structure; very friable; common fine roots; 3 percent gravel; neutral; abrupt wavy boundary.

B1—10 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam; moderate medium subangular blocky structure; very friable; few fine roots; 5 percent gravel; neutral; clear wavy boundary.

B21t—17 to 26 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

B22t—26 to 33 inches; yellowish brown (10YR 5/4) fine sandy loam; moderate coarse subangular blocky structure; friable; few fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

B23t—33 to 47 inches; yellowish brown (10YR 5/4) sandy clay loam; weak coarse subangular blocky structure; friable; thin patchy dark yellowish brown (10YR 3/4) clay films in channels; 4 percent gravel; neutral; clear wavy boundary.

C—47 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam; massive; friable; 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 75 inches thick. The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3 and hue of 10YR, value of 6, and chroma of 2 or 3 dry. It is dominantly fine sandy loam, but the range includes sandy loam or loamy sand. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4. It is sandy loam, fine sandy loam, loam, or sandy clay loam. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4. It is fine sandy loam, sandy loam, or loamy sand.

Houghton series

The Houghton series consists of deep, very poorly drained, moderately slowly to moderately rapidly permeable soils. They formed in herbaceous organic deposits deeper than 51 inches on lake plains, outwash plains, till plains, and glacial moraines. Slopes range from 0 to 2 percent.

Houghton soils are commonly adjacent to Bono, Pewamo, Rensselaer, and Wallkill soils. The Bono, Pewamo, and Rensselaer soils consist of mineral materials and are slightly higher on the landscape than Houghton soils. The Wallkill soils consist of mineral materials that are 16 to 40 inches thick.

Typical pedon of Houghton muck, drained, in a cultivated field, 1,300 feet west and 225 feet north of the southeast corner of sec. 6, T. 34 N., R. 13 E.

Oap—0 to 7 inches; black (N 2/0) sapric material, black (10YR 2/1) dry, black (N 2/0) rubbed and pressed; about 5 percent fibers, less than 1 percent rubbed; weak medium subangular blocky structure parting to weak fine granular; friable; many fine roots; very dark brown (10YR 2/2) sodium pyrophosphate; 20 percent mineral content; slightly acid (pH 6.2 in water); abrupt smooth boundary.

Oa1—7 to 13 inches; black (N 2/0) sapric material broken, rubbed, and pressed; about 5 percent fibers, less than 1 percent rubbed; moderate coarse subangular blocky structure parting to weak thick platy; friable; many fine roots; black (10YR 2/1) sodium pyrophosphate; 20 percent mineral content; slightly acid (pH 6.2 in water); clear wavy boundary.

Oa2—13 to 19 inches; dark reddish brown (5YR 2/2) sapric material broken and pressed; black (N 2/0) rubbed; about 30 percent fibers, 2 percent rubbed; weak thick platy structure; friable; common fine roots; dark brown (10YR 3/3) sodium pyrophosphate; 30 percent mineral content; slightly acid (pH 6.2 in water); clear wavy boundary.

Oa3—19 to 39 inches; black (5YR 2/1) sapric material broken, rubbed, and pressed; about 25 percent fibers, 1 percent rubbed; weak thick platy structure; friable; brown (10YR 5/3) sodium pyrophosphate; few partially decomposed woody fibers; 20 percent mineral content; medium acid (pH 5.8 in water); clear wavy boundary.

Oa4—39 to 51 inches; dark reddish brown (5YR 3/3) sapric material broken, dark reddish brown (5YR 2/2) rubbed, dark reddish brown (5YR 3/2) pressed; about 30 percent fibers, 10 percent rubbed; weak thick platy structure; friable; pale brown (10YR 6/3) sodium pyrophosphate; 20 percent mineral content; medium acid (pH 6.0 in water); clear wavy boundary.

Oe1—51 to 60 inches; brown (7.5YR 4/4) hemic material broken, dark yellowish brown (10YR 3/4) rubbed, dark brown (10YR 3/3) pressed; about 80 percent fibers, 30 percent rubbed; weak thick platy structure; friable; white (10YR 8/2) sodium pyrophosphate; 10 percent mineral content; neutral (pH 6.6 in water).

The organic layers are more than 51 inches thick. The organic materials are primarily herbaceous, but some layers contain as much as 15 percent woody material. Layers within the control section have hue of 10YR, 7.5YR, or 5YR; value of 2 to 4; and chroma of 0 to 3. Colors of broken faces become darker on brief exposure to air. The layers in the subsurface tier are dominantly sapric material but may have up to about 9 inches of hemic material.

Landes series

The Landes series consists of deep, moderately well drained and well drained soils on flood plains. They

formed in alluvium. Permeability is moderately rapid or rapid. Slopes range from 0 to 2 percent.

Landes soils are commonly adjacent to Eel soils. Eel soils are in the more depressional areas, have more clay in the profile than Landes soils, and have mottles of low chroma within 20 inches of the surface.

Typical pedon of Landes fine sandy loam, frequently flooded, in a cultivated field, 1,580 feet east and 300 feet north of the southwest corner of sec. 29, T. 34 N., R. 15 E.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; few fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

B1—12 to 26 inches; brown (10YR 4/3) fine sandy loam; weak coarse subangular blocky structure; friable; few fine roots; thin patchy very dark grayish brown (10YR 3/2) organic stains; 2 percent gravel; neutral; gradual wavy boundary.

B2—26 to 36 inches; brown (10YR 4/3) fine sandy loam; weak coarse subangular blocky structure; friable; 2 percent gravel; neutral; gradual wavy boundary.

C1—36 to 52 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; neutral; gradual wavy boundary.

C2—52 to 60 inches; brown (10YR 4/3) silt loam; massive; friable; neutral.

The solum is 25 to 40 inches thick. Fine sandy loam or sandy loam typically occurs between depths of 10 and 40 inches.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3 and hue of 10YR, value of 5, and chroma of 2 or 3 dry. It is fine sandy loam or sandy loam. The B horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is fine sandy loam or sandy loam that has layers of loam or silt loam. The B horizon is slightly acid or neutral. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4 and is mottled in some pedons. It is stratified with textures of sandy loam, fine sandy loam, loam, or silt loam. The C horizon is neutral to moderately alkaline.

Martisco series

The Martisco series consists of deep, very poorly drained, slowly permeable soils in marshy depressions on old lakebeds. They formed in organic deposits over marl. Slopes range from 0 to 2 percent.

Martisco soils are commonly adjacent to Houghton and Rensselaer soils. Houghton soils have organic materials throughout and do not have marl. Rensselaer soils do not contain organic material and are higher on the landscape than Martisco soils.

Typical pedon of Martisco muck, undrained, in a cultivated field, 460 feet south and 1,490 feet east of the northwest corner of sec. 10, T. 35 N., R. 12 E.

Oap—0 to 10 inches; black (N 2/0) sapric material, black (N 2/0) dry; about 5 percent fiber, less than one percent rubbed; moderate medium granular structure; friable; many fine and few medium roots; 15 percent mineral; black (10YR 2/1) in sodium pyrophosphate; slight effervescence; mildly alkaline; abrupt smooth boundary.

Lca1—10 to 13 inches; grayish brown (10YR 5/2) marl; weak medium subangular blocky structure; friable; common fine roots; many medium white (10YR 8/2) shell fragments; strong effervescence; moderately alkaline; clear wavy boundary.

Lca2—13 to 25 inches; light grayish brown (2.5Y 6/2) marl; weak coarse subangular blocky structure; friable; common fine roots; common medium white (10YR 8/2) shell fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

Lca3—25 to 60 inches; gray (5Y 5/1) marl; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; common medium white (10YR 8/2) shell fragments; strong effervescence; moderately alkaline.

The thickness of the organic surface layer is 8 to 16 inches.

The Oap horizon has hue of 10YR or N, value of 2, and chroma of 0 or 1. The Lca horizon has hue of 2.5Y, 5Y, or 10YR; value of 5 or 6; and chroma of 1 or 2.

Metea series

The Metea series consists of deep, well drained soils formed in windblown sand or loamy sand and the underlying glacial till. Permeability is rapid in the upper part of the solum and slow in the lower part and in the underlying material. Slopes range from 2 to 6 percent. These soils have more clay in the subsoil and underlying material than is defined as the range for the Metea series. This difference does not alter the use or behavior of the soil.

Metea soils are commonly adjacent to Blount, Boyer, Haskins, and Morley soils. The Blount and Haskins soils have less sand in the solum and are lower on the landscape than Metea soils. Boyer soils are underlain by calcareous sand and gravel at a depth of less than 40 inches and are lower on the landscape. Morley soils have more clay in the surface layer and upper subsoil and are higher on the landscape.

Typical pedon of Metea loamy sand, 2 to 6 percent slopes, in a cultivated field, 2,100 feet north and 1,000 feet east of the southwest corner of sec. 7, T. 33 N., R. 15 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, pale brown (10YR 6/3) dry; weak coarse granular structure; very friable; few fine roots; medium acid; abrupt smooth boundary.

A21—9 to 18 inches; yellowish brown (10YR 5/4) loamy sand; weak coarse subangular blocky structure; very friable; few fine roots; medium acid; clear wavy boundary.

A22—18 to 29 inches; dark yellowish brown (10YR 4/4) sand; weak medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

B21t—29 to 35 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; thin continuous dark brown (10YR 3/3) clay films on faces of peds; neutral; abrupt wavy boundary.

IIB22t—35 to 40 inches; dark yellowish brown (10YR 4/6) clay; weak medium angular blocky structure; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

IIB3t—40 to 46 inches; yellowish brown (10YR 5/4) clay loam; weak thin platy structure parting to weak coarse angular blocky; firm; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; common white (10YR 8/2) carbonate coatings on faces of peds; 3 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC—46 to 60 inches; yellowish brown (10YR 5/4) clay loam; massive; firm; 3 percent gravel; strong effervescence; moderately alkaline.

The solum is 36 to 60 inches thick. The thickness of the loamy sand or sand upper horizons is 20 to 40 inches. The Ap horizon has hue of 10YR, value of 6 or 7, and chroma of 2 or 3 dry. It is loamy sand or sand. The A2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand or sand. The B2t horizon has hue of 10YR, value of 3 or 5, and chroma of 3 or 4. It is sandy loam, loamy sand, loamy fine sand, or sandy clay loam. The IIB2t horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay, silty clay, silty clay loam, or clay loam. The IIB3 and IIC horizons are silty clay or clay loam.

Morley series

The Morley series consists of deep, well drained, slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 6 to 30 percent.

Morley soils are similar to Glynwood soils and are commonly adjacent to Blount, Haskins, Pewamo, and Rawson soils. Glynwood soils have mottles of low chroma in the upper subsoil. Blount and Haskins soils have mottles of low chroma in the upper subsoil and are lower on the landscape than Morley soils. Rawson soils have less clay in the subsoil. Pewamo soils have a dark surface layer and gray subhorizons and are in depressional positions.

Typical pedon of Morley silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 2,475 feet south and 1,320 feet east of the northwest corner of sec. 14, T. 34 N., R. 13 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; about 10 percent dark brown (10YR 4/3) silty clay loam; 3 percent gravel; medium acid; abrupt smooth boundary.

B21t—8 to 13 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous brown (10YR 5/3) clay films on faces of peds; 3 percent gravel; medium acid; clear wavy boundary.

B22t—13 to 19 inches; brown (10YR 4/3) clay; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 5/3) clay films on faces of peds; 4 percent gravel; medium acid; clear wavy boundary.

B23t—19 to 25 inches; dark brown (10YR 4/3) clay; moderate medium angular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

C1—25 to 30 inches; brown (10YR 5/3) silty clay loam; moderate medium angular blocky structure; firm; thin patchy light brownish gray (10YR 6/2) clay films and carbonate coatings on internal planes; 3 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C2—30 to 60 inches; brown (10YR 5/3) silty clay loam; massive; firm; thin patchy gray (10YR 5/1) carbonate coatings on internal planes; 3 percent gravel; violent effervescence; moderately alkaline.

The solum is 20 to 38 inches thick. The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is silt loam or silty clay loam and includes some loam. The B2t horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is silty clay loam, clay loam, silty clay, or clay and is strongly acid to neutral. The C horizon is silty clay loam or clay loam.

Ormas series

The Ormas series consists of deep, well drained soils on terraces. Permeability is moderately rapid in the solum and very rapid in the underlying material. These soils formed in wind-reworked glacial outwash. Slopes range from 0 to 6 percent. These soils have bands or lamellae in the upper part of the subsoil, which are not

definitive for the Ormas series. This difference does not alter the use or behavior of the soil.

Ormas soils are similar to Boyer and Oshtemo soils and are commonly adjacent to Rensselaer and Sebewa soils. Boyer soils have calcareous sand and gravelly sand at a depth of 40 inches or less. Oshtemo soils have less sand in the upper part of the solum than Ormas soils. Rensselaer and Sebewa soils have a dark surface layer, have more clay in the solum, and are in depressions.

Typical pedon of Ormas loamy sand, 0 to 6 percent slopes, in a cultivated field, 2,305 feet east and 444 feet north of the southwest corner of sec. 22, T. 33 N., R. 14 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak coarse granular structure; very friable; common fine roots; 1 percent gravel; slightly acid; abrupt smooth boundary.

A2—10 to 27 inches; brown (10YR 5/3) loamy sand; single grain; loose; few fine roots; 1 percent gravel; slightly acid; abrupt wavy boundary.

A&B—27 to 38 inches; brown (10YR 4/3) loamy sand (A2); single grain; loose; brown (7.5YR 4.4) sandy loam lamellae (B2t); 9 percent gravel; slightly acid; abrupt wavy boundary.

B21t—38 to 48 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few thin clay films; 6 percent gravel; medium acid; clear wavy boundary.

B22t—48 to 53 inches; brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; few thin clay films; 10 percent gravel; slightly acid; clear wavy boundary.

B23t—53 to 55 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; few thin clay films; 20 percent gravel; slightly acid; abrupt irregular boundary.

IIC—55 to 60 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; 25 percent gravel; strong effervescence; moderately alkaline.

The solum is 45 to 75 inches thick. The A horizon has hue of 10YR, value of 3 to 5, and chroma of 3 and hue of 10YR, value of 6 or 7, and chroma of 3 dry. It is medium acid to neutral. The A part of the A&B horizon is similar to the A horizon, and the B part has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4. These bands are about 1/8 inch to 2 inches or more thick and are sandy loam or loamy sand. Depth of the bands ranges from 24 to 40 inches. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4. The IIC horizon has strata which range widely in thickness and texture from sand to gravelly coarse sand.

Oshtemo series

The Oshtemo series consists of deep, well drained soils on outwash plains, terraces, and moraines. Permeability is moderately rapid in the solum and very rapid in the underlying material. These soils formed in glacial outwash. Slopes range from 0 to 6 percent.

Oshtemo soils are similar to Boyer and Ormas soils and are commonly adjacent to Rensselaer and Sebewa soils. Boyer soils have calcareous sand and gravelly sand at a depth of 40 inches or less. Ormas soils are loamy sand in the surface and subsurface layers. Rensselaer and Sebewa soils have dark surface layers and are in depressional areas.

Typical pedon of Oshtemo sandy loam, 0 to 6 percent slopes, in a cultivated field, 420 feet east and 950 feet north of the southwest corner of sec. 3, T. 35 N., R. 14 E.

Ap—0 to 12 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; common fine and medium roots; 10 percent gravel; slightly acid; abrupt smooth boundary.

B21t—12 to 25 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; common fine and medium roots; few thin discontinuous clay films; 14 percent gravel; medium acid; clear wavy boundary.

B22t—25 to 38 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam; weak medium subangular blocky structure; friable; common fine roots; few thin discontinuous clay films; 22 percent gravel; medium acid; abrupt wavy boundary.

B23—38 to 47 inches; dark yellowish brown (10YR 3/4) fine sandy loam; weak medium subangular blocky structure; friable; common fine roots; few thin discontinuous clay films; 13 percent gravel; medium acid; abrupt irregular boundary.

IIC—47 to 60 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; 30 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 66 inches thick. The Ap horizon is loamy sand or sandy loam and is medium acid to neutral. The B2t horizon has hue of 10YR and 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, or sandy clay loam or their gravelly analogs. The IIC horizon is sand or gravelly coarse sand.

Pewamo series

The Pewamo series consists of deep, very poorly drained, moderately slowly permeable soils. They formed in glacial till in depressional areas on moraines and till plains. Slopes range from 0 to 2 percent. These soils have no evidence of an argillic horizon, the organic matter content does not decrease with depth, and the

clay content of the C horizon is less than is defined as the range for the Pewamo series. These differences do not alter the use or behavior of the soil.

Pewamo soils are similar to Bono soils and are commonly adjacent to Blount, Morley, and Rensselaer soils. Bono soils formed in lacustrine deposits. Blount soils do not have a dark surface layer, are not as gray in the subsoil, and are in higher lying areas than Pewamo soils. The Morley soils do not have the gray color in the solum. Rensselaer soils have less clay throughout the profile.

Typical pedon of Pewamo silty clay, in a cultivated field, 1,480 feet east and 96 feet south of the northwest corner of sec. 16, T. 33 N., R. 13 E.

Ap—0 to 10 inches; black (10YR 2/1) silty clay, gray (10YR 5/1) dry; weak coarse granular structure; friable; many fine roots; 8 percent gravel; neutral; abrupt smooth boundary.

B21tg—10 to 18 inches; dark gray (10YR 4/1) silty clay; many fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; common fine roots; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; many distinct very dark brown (10YR 2/2) organic stains on faces of peds; 2 percent gravel; neutral; clear wavy boundary.

B22tg—18 to 34 inches; gray (10YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; firm; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; 3 percent gravel; neutral; gradual wavy boundary.

C1g—34 to 44 inches; dark grayish brown (10YR 4/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; thin patchy dark gray (10YR 4/1) clay films on faces of peds; 3 percent coarse fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—44 to 60 inches; dark grayish brown (2.5YR 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; many distinct light gray (N 7/0) carbonate coatings on internal planes; 8 percent gravel; strong effervescence; moderately alkaline.

The solum is 28 to 50 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 and hue of 10YR, value of 4 or 5, and chroma of 1 dry. It is dominantly silty clay, but the range includes silty clay loam or clay loam. The B2tg horizon is mottled and has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay, clay, clay loam, or silty clay loam. It is slightly acid or neutral. The C horizon is mottled and has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay loam or clay loam.

Rawson series

The Rawson series consists of deep, moderately well drained or well drained soils on terraces and moraines. Permeability is moderate in the upper part of the solum and slow in the lower part of the solum and the underlying material. These soils formed in loamy material over glacial till. Slopes range from 2 to 6 percent. These soils have less clay in the underlying material than is defined as the range for the Rawson series. This difference, however, does not alter the use or behavior of the soil.

Rawson soils are similar to Strawn soils and are commonly adjacent to Blount, Haskins, Morley, and Pewamo soils. Strawn soils have less clay in the lower part of the subsoil and the underlying material than Rawson soils. Blount soils have more clay in the subsoil, have gray colors throughout the solum, and are in lower areas. Haskins soils are lower on the landscape and have gray colors throughout the solum. Morley soils have more clay in the subsoil. Pewamo soils are in depressions and have a dark surface layer.

Typical pedon of Rawson sandy loam, 2 to 6 percent slopes, in a cultivated field, 500 feet east and 730 feet north of the southwest corner of sec. 22, T. 33 N., R. 14 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak coarse granular structure; friable; common fine roots; 1 percent gravel; medium acid; abrupt smooth boundary.

B21t—10 to 13 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; thin patchy dark yellowish brown (10YR 3/4) clay films on faces of peds; 1 percent gravel; neutral; clear wavy boundary.

B22t—13 to 20 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; thin continuous dark yellowish brown (10YR 3/4) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

B23t—20 to 28 inches; brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thin continuous brown (7.5YR 4/4) clay films on faces of peds; 8 percent gravel; slightly acid; clear wavy boundary.

B24t—28 to 39 inches; dark yellowish brown (10YR 4/4) loam; moderate coarse subangular blocky structure; friable; thin continuous dark yellowish brown (7.5YR 4/4) clay films on faces of peds; 3 percent gravel; neutral; clear wavy boundary.

IIC1—39 to 43 inches; brown (10YR 4/3) silty clay loam; weak coarse subangular blocky structure; firm; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 2 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2—43 to 60 inches; brown (10YR 4/3) silty clay loam; massive; firm; 2 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 48 inches thick. The Ap horizon is dark brown (10YR 3/3) or brown (10YR 4/3) and has hue of 10YR, value of 6 or 7, and chroma of 3 dry. It is sandy loam or loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam, sandy clay loam, loam, or clay loam or their gravelly analogs. It is strongly acid to neutral. The IIC horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is clay loam or silty clay loam that has less than 35 percent clay.

Rensselaer series

The Rensselaer series consists of deep, very poorly drained soils along drainageways and in depressions on terraces and glacial till plains. These soils are slowly permeable in the subsoil and moderately permeable in the underlying material. They formed in stratified outwash sediments. Slopes range from 0 to 2 percent.

Rensselaer soils are similar to Sebewa soils and are commonly adjacent to Blount, Houghton, Pewamo, Strawn, and Whitaker soils. Sebewa soils are underlain by gravelly sand. Blount soils formed in till, have a higher clay content than Rensselaer soils, and are on higher positions on the landscape. Houghton soils consist of organic materials throughout the profile and occur in depressions. Pewamo soils formed in till and have more clay throughout the profile. Strawn soils formed in till and are on higher positions on the landscape. Whitaker soils have less gray in the solum and are higher on the landscape.

Typical pedon of Rensselaer loam, in a cultivated field, 2,140 feet west and 360 feet south of the northeast corner of sec. 7, T. 34 N., R. 14 E.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak coarse granular structure; friable; common fine roots; 3 percent gravel; slightly acid; abrupt smooth boundary.

B1g—10 to 14 inches; dark gray (10YR 4/1) loam; few fine distinct strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure; friable; few fine roots; 2 percent gravel; slightly acid; clear wavy boundary.

B21tg—14 to 26 inches; dark gray (10YR 4/1) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds and in pores; 4 percent gravel; neutral; clear wavy boundary.

B22tg—26 to 41 inches; gray (5Y 5/1) silty clay loam; common medium distinct light olive brown (2.5Y 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; thin continuous grayish brown (2.5Y 5/2) clay films on faces of peds; 1 percent gravel; neutral; clear wavy boundary.

C1g—41 to 46 inches; grayish brown (2.5Y 5/2) sandy loam; common medium distinct light olive brown (2.5Y 5/6) mottles; weak coarse subangular blocky structure; friable; 2 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C2g—46 to 50 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many coarse distinct light olive brown (2.5Y 5/6) mottles; massive; firm; 1 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C3g—50 to 55 inches; grayish brown (10YR 5/2) loamy sand; single grain; loose; 1 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C4g—55 to 60 inches; dark grayish brown (2.5Y 4/2) and gray (5Y 5/1) silty clay loam; massive; firm; strong effervescence; moderately alkaline.

The solum is 35 to 60 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 and hue of 10YR, value of 4 or 5, and chroma of 1 or 2 dry. It is loam or silt loam. The B2t horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2 and is mottled. It is silty clay loam or clay loam with subhorizons of silt loam, loam, or sandy clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 1 or 2. It is stratified clay loam, fine sand, silty clay loam, sandy loam, loamy sand, and loam.

Sebewa series

The Sebewa series consists of very poorly drained soils that are moderately deep over sand and gravel. They formed in glacial outwash on terraces and outwash plains. Permeability is moderate in the solum and rapid in the underlying material. Slopes range from 0 to 2 percent. These soils do not have an argillic horizon, which is definitive for the Sebewa series. This difference does not alter the use or behavior of the soil.

Sebewa soils are similar to Rensselaer soils and are commonly adjacent to Boyer, Ormas, and Oshtemo soils. Rensselaer soils have more silt and clay in the underlying material than Sebewa soils. Boyer and

Oshtemo soils have less clay in the subsoil and are higher on the landscape. Ormas soils have more sand in the surface and subsurface layers and are on higher lying positions.

Typical pedon of Sebewa sandy loam, in a cultivated field, 800 feet north and 2,280 feet west of the southeast corner of sec. 30, T. 35 N., R. 14 E.

Ap—0 to 11 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak coarse granular structure; friable; few fine roots; 4 percent gravel; slightly acid; abrupt smooth boundary.

B21tg—11 to 16 inches; gray (5Y 5/1) sandy clay loam; common coarse distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; thin patchy dark gray (5Y 4/1) clay films on faces of peds; 9 percent gravel; slightly acid; clear wavy boundary.

B22tg—16 to 25 inches; gray (5Y 5/1) sandy clay loam; common coarse distinct yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure; friable; thin discontinuous dark gray (5Y 4/1) clay films on faces of peds; 8 percent gravel; neutral; clear wavy boundary.

B3g—25 to 29 inches; gray (10YR 5/1) loamy sand; weak coarse subangular blocky structure; very friable; 10 percent gravel; neutral; clear irregular boundary.

IICg—29 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; 20 percent gravel; strong effervescence; mildly alkaline.

The solum is 20 to 40 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 and hue of 10YR, value of 4 or 5, and chroma of 1 dry. It is dominantly sandy loam, but the range includes loam and sandy clay loam. The Bt horizon has hue of 2.5Y, 5Y, or 10YR; value of 4 or 6; and chroma of 1 or 2 and is mottled. It is clay loam, sandy clay loam, or loam or their gravelly analogs. The IIC horizon is stratified sand or coarse sand or their gravelly analogs.

Strawn series

The Strawn series consists of deep, well drained soils on moraines. Permeability is moderate. These soils formed in glacial till. Slopes range from 0 to 18 percent.

Strawn soils are similar to Rawson soils and are commonly adjacent to Conover and Rensselaer soils on the landscape. Rawson soils have more clay in the lower part of the subsoil and the underlying material than Strawn soils. Conover soils are lower on the landscape, have a mollic epipedon, and have mottles lower in chroma throughout the subsoil. Rensselaer soils are stratified in the underlying material and are lower on the landscape.

Typical pedon of Strawn loam, 2 to 6 percent slopes, eroded, in a cultivated field, 1,600 feet north and 2,500 feet east of the southwest corner of sec. 11, T. 35 N., R. 12 E.

Ap—0 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; few fine roots; about 15 percent dark yellowish brown (10YR 4/4) clay loam; 3 percent gravel; slightly acid; abrupt smooth boundary.

B21t—8 to 15 inches; dark yellowish brown (10YR 4/4) loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; 2 percent gravel; medium acid; clear wavy boundary.

B22t—15 to 23 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin continuous brown (10YR 4/3) clay films on faces of peds; 1 percent gravel; medium acid; clear wavy boundary.

C1—23 to 28 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films on faces of peds; 4 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C2—28 to 60 inches; brown (10YR 5/3) loam; massive; friable; 4 percent gravel; strong effervescence; moderately alkaline.

The solum is 16 to 27 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam or clay loam and less commonly sandy loam. The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, silty clay loam, sandy clay loam, and loam. It is medium acid to neutral.

Wallkill series

The Wallkill series consists of deep, very poorly drained soils in glacial-plain depressions. They formed in 16 to 40 inches of alluvium underlain by organic material. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Slopes range from 0 to 2 percent.

Wallkill soils are commonly adjacent to Blount, Bono, Conover, Houghton, and Rensselaer soils. None of these soils have organic material under the mineral solum, except Houghton soils which are all organic. The Blount, Bono, Conover, and Rensselaer soils are on higher positions on the landscape.

Typical pedon of Wallkill silt loam, in a cultivated field, 2,610 feet south and 1,960 feet east of the northwest corner of sec. 18, T. 35 N., R. 13 E.

Ap—0 to 9 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

Cg—9 to 20 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (10YR 6/2) dry; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; friable; few fine roots; neutral; clear wavy boundary.

IIOa1—20 to 23 inches; black (N 2/0) sapric material broken, rubbed, and pressed; about 20 percent fibers, less than 1 percent rubbed; massive; friable; slightly acid; clear wavy boundary.

IIOa2—23 to 26 inches; dark reddish brown sapric material, (5YR 3/3) broken, (5YR 2/2) rubbed, (5YR 3/2) pressed; about 25 percent fibers; 2 percent rubbed; massive; friable; slightly acid; clear wavy boundary.

IIOa3—26 to 34 inches; sapric material, dark reddish brown (5YR 2/2) broken, black (5YR 2/2) rubbed, dark reddish brown (5YR 3/2) pressed; about 30 percent fibers, 3 percent rubbed; moderate thick platy structure; friable; slightly acid; clear wavy boundary.

IIOa4—34 to 63 inches; dark reddish brown sapric material, (5YR 2/2) broken and rubbed, (5YR 3/3) pressed; about 35 percent fibers, 1 percent rubbed; massive; neutral.

The mineral portion of the profile is 16 to 40 inches thick and ranges from strongly acid to mildly alkaline. The organic portion of the profile ranges from medium acid to mildly alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 or 2. The Cg horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2 and is silt loam or loam. Some pedons have a B horizon. Some pedons have dark-colored mineral horizons above the organic layers. The organic layers have hue of 5YR, 10YR, or 2.5Y; value of 2 or 3, and chroma of 0 to 3. The organic layers consist of sapric and hemic materials. Some pedons have mineral horizons within the organic layers.

Whitaker series

The Whitaker series consists of deep, somewhat poorly drained soils on glacial outwash terraces. Permeability is moderate. These soils formed in stratified outwash sediments. Slopes range from 0 to 2 percent.

Whitaker soils are commonly adjacent to the Blount, Conover, and Rensselaer soils. Blount soils have more clay in the solum and underlying material than Whitaker soils. Conover soils lack stratification in the underlying material. Rensselaer soils have a dark surface layer.

A typical pedon of Whitaker silt loam, in a cultivated field, 300 feet north and 700 feet west of the southeast corner of sec. 21, T. 34 N., R. 13 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; few fine roots; medium acid; abrupt smooth boundary.

A2—9 to 11 inches; brown (10YR 5/3) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate thick platy structure; friable; few fine roots; medium acid; clear smooth boundary.

B21t—11 to 17 inches; yellowish brown (10YR 5/4) loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; medium acid; clear wavy boundary.

B22t—17 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; many coarse distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; medium acid; clear wavy boundary.

B3g—28 to 56 inches; gray (10YR 5/1) silt loam with thin strata of very fine sand, fine sandy loam, and clay loam; many coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; 3 percent gravel; neutral; clear wavy boundary.

Cg—56 to 60 inches; gray (10YR 5/1) silt loam with strata of very fine sand, fine sandy loam, and loamy sand; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3 and is loam or silt loam. The B horizon has hue of 10YR, value of 5, and chroma of 1 to 4 and is mottled. It is silt loam, clay loam, silty clay loam, loam, or sandy clay loam. The C horizon is stratified silt loam, very fine sand, fine sandy loam, and loamy sand.

formation of the soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are discussed.

factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of glacial deposits and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material

Parent material is the unconsolidated mass from which a soil is formed. The parent materials of the soils of DeKalb County were deposited by glaciers or by melt water from the glaciers. Some of these materials were reworked and redeposited by subsequent actions of water and wind. These glaciers covered the county from about 12,000 to 15,000 years ago. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although most parent materials of the county are of glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in DeKalb County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. Some of the small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing. The glacial till in DeKalb County is calcareous and firm. Its texture is sandy loam, loam, silty clay loam, or clay loam. The Morley soils are an example of soils formed in glacial till. These soils typically are fine textured and have well-developed structure.

Outwash materials were deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the velocity of the water that carried them. When the fast-moving water slowed down, the coarser particles were deposited. Finer particles, such as very fine sand, silt, and clay were carried farther by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. The Boyer soils, for example, formed in deposits of outwash material.

Lacustrine materials were deposited from still, or ponded, glacial melt water. Because the coarser fragments dropped out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. Lacustrine deposits are silty or clayey in texture. In DeKalb County soils formed in lacustrine deposits are typically fine textured. The Bono series is an example of soils formed in lacustrine materials.

Alluvial material was deposited by floodwaters of streams in recent time. This material varies in texture depending on the speed of the water from which it was deposited. The alluvium deposited along a swift stream like the St. Joseph River is, therefore, coarser textured than that deposited along a slow, sluggish stream like Cedar Creek. Examples of alluvial soils are the Eel and Landes series.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions on outwash plains, lake plains, and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains

fell to the bottom but did not decompose. Later, white-cedar and other water-tolerant trees grew in the areas. As these trees died, their residues became a part of the organic accumulation. The lakes were eventually filled with organic material. Some of the plant remains subsequently decomposed and developed into areas of muck. In other areas, the material has changed little since deposition. Soils of the Houghton series are an example of soils formed in organic material.

plant and animal life

Plants have been the principal organism influencing the soils in DeKalb County; however, bacteria, fungi, earthworms, and burrowing animals have also been important. By such activities as tilling, man has also contributed to soil formation. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on it. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by plants.

The vegetation in the county was mainly deciduous forests. Differences in natural soil drainage and minor changes in parent material have affected the composition of the forest species.

In general, the well drained upland soils, such as those of the Morley series, were mainly covered with sugar maple and beech. The wet soils supported primarily herbaceous plants, shrubs, and water-tolerant trees. The soils of the county, which developed under dominantly forest vegetation, generally have less total accumulation of organic matter than soils in other parts of the state that developed under dominantly grass vegetation.

climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for the weathering of minerals and the transporting of soil materials. Climate, through its influence on temperatures in the soil, determines the rate of chemical reactions that occur in the soil. These influences are important, but they affect large areas rather than a relatively small area, such as a county.

The climate of DeKalb County is cool and humid. It is presumably similar to that which existed when the soils were being formed. The soils in the county differ from soils that formed in a dry, warm climate or from those that formed in a hot, moist climate. Climate is uniform throughout the county, although its effect is modified locally by position on the landscape.

The differences in the soils of DeKalb County, therefore, are only to a minor extent the result of differences in climate. For more detailed information on the climate of this county, see the section "General nature of the survey area."

relief

Relief, or topography, has a marked influence on the soils through its influence on natural drainage, erosion, plant cover, and soil temperature. In DeKalb County, slopes range from 0 to 30 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage; drainage, in turn, through its effect on aeration of the soil, determines the color of the soil. Runoff is greatest on the steeper slopes; but in low areas, water is temporarily ponded. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized, and in poorly aerated soils the colors are dull gray and mottled. The Morley series is an example of a well drained, well aerated soil, and the Pewamo series is an example of a poorly aerated, very poorly drained soil. Intermediate between the very poorly drained and well drained soils, are the poorly drained, somewhat poorly drained, and moderately well drained soils.

time

Time, usually a long time, is required by the agents of soil formation to form distinct horizons in the soil from parent material. The differences in length of time that the parent material has been in place reflect the degree of development of the soil profile. Some soils develop rapidly; others, slowly.

The soils in the county range from young to mature. The glacial deposits from which many of the soils formed have been exposed to soil-forming factors for a long enough time to allow distinct horizons to develop within the soil profile. Some soils, however, that formed in recent alluvial sediments have not been in place long enough for distinct horizons to develop.

The Eel series is an example of a young soil formed in alluvial material. It has weakly developed horizons. The Glynwood series, on the other hand, has been forming for several thousand years and has distinct horizons.

processes of soil formation

Several processes have been involved in the formation of the soils in this county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In

most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils of this county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, like soils of the Pewamo or Rensselaer series, have a thick black surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils of this county. Leaching is generally believed to precede the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because the water table is high or because water moves slowly through such soils.

Clay particles accumulate in pores and other voids and form films on the surface along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. Soils of the Strawn series are examples of soils in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained and somewhat poorly drained soils of this county. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron.

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glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base material. Material which is added to some soils to increase the load bearing capacity of the soil. Aggregate or sand and gravel is often used to increase the strength of a soil with a high percentage of clay.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms. The Lco horizon is a limnic layer that contains many fecal pellets.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Use of that portion of the plant or crop left in the field after harvest for protection or improvement of the soil.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, subsurface. Removal of excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsidence. The settlement of organic soils. Subsidence results from either dessication and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Underlying material. See Substratum.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-76 at Waterloo, Indiana]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days[1]	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	32.0	15.9	24.0	59	-14	10	1.89	0.77	2.78	5	6.2
February	36.3	18.5	27.4	60	-12	10	1.82	.83	2.61	5	6.5
March	45.8	26.3	36.1	76	1	73	2.67	1.45	3.66	7	4.0
April	60.6	37.0	48.8	83	18	273	3.43	2.36	4.40	8	1.4
May	71.6	46.6	59.1	89	27	592	3.58	2.44	4.61	8	.0
June	81.6	56.5	69.1	95	38	873	3.37	2.02	4.58	6	.0
July	84.4	60.0	72.2	96	44	998	3.55	1.91	4.89	7	.0
August	83.1	57.8	70.5	95	41	946	2.92	1.40	4.16	5	.0
September	76.6	50.7	63.7	94	30	711	3.00	1.36	4.32	6	.0
October	65.3	40.4	52.9	85	20	407	2.60	.90	3.96	6	.2
November	48.9	30.7	39.8	73	8	107	2.68	1.52	3.61	6	2.5
December	36.2	20.7	28.5	63	-10	28	2.57	.88	3.91	6	6.6
Yearly:											
Average	60.2	38.4	49.3	---	---	---	---	---	---	---	---
Extreme	---	---	---	97	-18	---	---	---	---	---	---
Total	---	---	---	---	---	5,028	34.08	28.89	38.42	75	27.4

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-76 at Waterloo, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 23	May 12	May 25
2 years in 10 later than--	April 19	May 6	May 19
5 years in 10 later than--	April 11	April 25	May 8
First freezing temperature in fall:			
1 year in 10 earlier than--	October 12	October 2	September 17
2 years in 10 earlier than--	October 18	October 7	September 22
5 years in 10 earlier than--	October 29	October 18	September 30

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-76 at Waterloo, Indiana]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	179	153	123
8 years in 10	186	161	130
5 years in 10	200	175	144
2 years in 10	215	189	158
1 year in 10	222	197	165

TABLE 4.--SUITABILITIES AND LIMITATIONS OF GENERAL SOIL MAP UNITS FOR SPECIFIED USES

Map unit	Extent of area	Cultivated crops	Pasture	Woodland	Urban uses	Intensive recreation areas	Extensive recreation areas
	Pct						
1. Blount-Pewamo-Glynwood	55	Well suited	Well suited	Suited: wetness.	Poorly suited: wetness, slow perm-eability.	Poorly suited: wetness, ponding, too clayey	Suited: erodes easily, ponding, too clayey.
2. Glynwood-Pewamo-Morley	32	Well suited	Well suited	Well suited	Poorly suited: wetness, slow perm-eability.	Suited: wetness, ponding, slope.	Suited: erodes easily, ponding, too clayey.
3. Strawn-Conover	6	Well suited	Well suited	Well suited	Suited: slope, wetness.	Suited: slope, wetness.	Suited: erodes easily, slope.
4. Boyer-Landes-Sebewa	5	Suited: droughty, flooding.	Well suited	Suited: droughty, wetness.	Poorly suited: seepage, flooding, ponding.	Suited: slope, flooding, ponding.	Suited: slope, flooding, ponding.
5. Boyer-Sebewa-Oshtemo	2	Suited: droughty.	Well suited	Suited: droughty, wetness.	Poorly suited: seepage, ponding.	Suited: slope, ponding, small stones.	Suited: slope, ponding.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BaA	Blount silt loam, 0 to 2 percent slopes	7,530	3.2
BaB2	Blount silt loam, 1 to 4 percent slopes, eroded	69,820	29.8
Bn	Bono silty clay	2,087	0.9
BoB	Boyer sandy loam, 0 to 6 percent slopes	6,642	2.8
BoC	Boyer sandy loam, 6 to 12 percent slopes	1,358	0.6
CrA	Conover loam, 0 to 3 percent slopes	1,352	0.6
Em	Eel loam, frequently flooded	1,803	0.8
GnB2	Glynwood loam, 3 to 6 percent slopes, eroded	33,450	14.2
HaA	Haskins loam, 0 to 3 percent slopes	1,834	0.8
HdB	Hillsdale fine sandy loam, 2 to 10 percent slopes	555	0.2
Hw	Houghton muck, drained	7,850	3.4
Ld	Landes fine sandy loam, frequently flooded	2,735	1.2
Mc	Martisco muck, undrained	311	0.1
MfB	Metea loamy sand, 2 to 6 percent slopes	1,195	0.5
MoC2	Morley silt loam, 6 to 12 percent slopes, eroded	2,296	1.0
MoD2	Morley silt loam, 12 to 18 percent slopes, eroded	610	0.3
MoE2	Morley silt loam, 18 to 30 percent slopes, eroded	371	0.2
MrC3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded	9,383	4.0
MrD3	Morley silty clay loam, 12 to 18 percent slopes, severely eroded	1,764	0.8
OdB	Ormas loamy sand, 0 to 6 percent slopes	1,253	0.5
OhB	Oshtemo sandy loam, 0 to 6 percent slopes	2,066	0.9
Pe	Pewamo silty clay	44,011	18.8
RaB	Rawson sandy loam, 2 to 6 percent slopes	6,489	2.8
Re	Rensselaer loam	9,067	3.9
Se	Sebewa sandy loam	4,701	2.0
SrB2	Strawn loam, 2 to 6 percent slopes, eroded	4,166	1.8
SrC2	Strawn loam, 6 to 12 percent slopes, eroded	512	0.2
StC3	Strawn clay loam, 6 to 12 percent slopes, severely eroded	2,214	0.9
StD3	Strawn clay loam, 12 to 18 percent slopes, severely eroded	583	0.2
Ud	Udorthents, loamy	1,214	0.5
Wa	Wallkill silt loam	2,408	1.0
Wt	Whitaker silt loam	1,392	0.6
	Water	1,218	0.5
	Total	234,240	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
BaA: Blount	106	35	48	4.3	7.2
BaB2: Blount	105	35	47	4.3	7.1
Bn: Bono	115	38	---	4.2	---
BoB: Boyer	80	30	35	2.9	---
BoC: Boyer	75	26	32	2.8	---
CrA: Conover	120	40	55	4.0	---
Em: Eel	90	31	---	3.5	7.0
GnB2: Glynwood	96	30	40	4.2	---
HaA: Haskins	110	40	46	4.4	---
HdB: Hillsdale	95	30	40	4.0	---
Hw: Houghton	115	34	---	---	---
Ld: Landes	58	19	---	1.9	---
Mc: Martisco	80	---	---	---	---
MfB: Metea	85	30	37	2.8	---
MoC2: Morley	95	32	44	4.0	---
MoD2: Morley	90	---	37	3.2	---
MoE2: Morley	---	---	---	3.1	---
MrC3: Morley	90	---	37	3.1	---
MrD3: Morley	---	---	---	3.3	---
OdB: Ormas	68	24	34	2.3	4.6
OhB: Oshtemo	90	30	38	2.5	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Pe------------------------ Pewamo	125	42	60	5.0	---
RaB----------------------- Rawson	100	32	42	4.0	---
Re------------------------ Rensselaer	140	50	56	4.7	9.4
Se------------------------ Sebewa	105	36	50	4.1	---
SrB2---------------------- Strawn	108	32	43	4.0	---
SrC2---------------------- Strawn	101	30	40	3.7	---
StC3---------------------- Strawn	90	27	35	3.3	---
StD3---------------------- Strawn	---	---	---	3.1	---
Ud**. Udorthents					
Wa------------------------ Wallkill	100	---	---	3.5	---
Wt------------------------ Whitaker	130	46	52	4.3	8.6

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	186,170	114,480	71,690	---
III	30,402	5,361	15,080	9,961
IV	12,518	12,207	311	---
V	---	---	---	---
VI	2,718	2,718	---	---
VII	---	---	---	---
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
BaA, BaB2 Blount	3c	Slight	Slight	Moderate	Moderate	White oak Northern red oak Green ash Pin oak	65 65 --- ---	Eastern white pine, red pine, yellow-poplar.
Bn Bono	3w	Slight	Severe	Severe	Severe	Pin oak Swamp white oak White ash Red maple American sycamore	80 --- --- --- ---	Red maple, eastern cottonwood, American sycamore, black willow.
BoB, BoC Boyer	3o	Slight	Slight	Slight	Slight	White oak Red pine Eastern white pine Northern red oak	70 75 65 75	Eastern white pine, red pine.
CrA Conover	3o	Slight	Slight	Slight	Slight	Northern red oak Pin oak Yellow-poplar	75 85 85	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
Em Eel	1o	Slight	Slight	Slight	Slight	Yellow-poplar Eastern cottonwood White ash Black walnut	100 --- --- ---	Eastern white pine, black walnut, yellow-poplar.
GnB2 Glynwood	2c	Slight	Slight	Moderate	Moderate	Northern red oak Black oak White oak Black walnut	80 80 80 ---	Eastern white pine, yellow-poplar, black walnut, white ash.
HaA Haskins	2o	Slight	Slight	Slight	Slight	White oak Northern red oak Pin oak Black walnut Black cherry Sugar maple White ash Yellow-poplar	75 80 90 --- --- --- --- ---	Red maple, white ash, eastern white pine, yellow-poplar, red pine, northern red oak, white oak.
HdB Hillsdale	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar	90 98	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Hw Houghton	4w	Slight	Severe	Severe	Severe	White ash Red maple Quaking aspen Black willow Silver maple	51 51 56 --- 76	
Ld Landes	1o	Slight	Slight	Slight	Slight	Eastern cottonwood Yellow-poplar American sycamore Green ash	105 95 --- ---	Sugar maple, eastern cottonwood, yellow-poplar, American sycamore, green ash, black walnut, eastern white pine.
Mc Martisco	4w	Slight	Severe	Severe	Severe	Red maple Green ash Quaking aspen Black willow Silver maple	55 55 56 --- ---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
MfB: Metea	2s	Slight	Slight	Moderate	Slight	White oak	80	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar	86	
						Eastern white pine	75	
						Red pine	75	
MoC2: Morley	2o	Slight	Slight	Slight	Slight	White oak	80	White oak, black walnut, green ash, eastern white pine, red pine.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
						Bur oak	---	
						Northern red oak	---	
						Shagbark hickory	---	
MoD2, MoE2: Morley	2r	Moderate	Moderate	Slight	Slight	White oak	80	White oak, black walnut, green ash, eastern white pine, red pine.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
						Bur oak	---	
						Northern red oak	---	
						Shagbark hickory	---	
MrC3: Morley	2o	Slight	Slight	Slight	Slight	White oak	80	White oak, black walnut, green ash, eastern white pine, red pine.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
						Bur oak	---	
						Northern red oak	---	
						Shagbark hickory	---	
MrD3: Morley	2r	Moderate	Moderate	Slight	Slight	White oak	80	White oak, black walnut, green ash, eastern white pine, red pine.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
						Bur oak	---	
						Northern red oak	---	
						Shagbark hickory	---	
OdB: Ormas	3s	Slight	Slight	Moderate	Slight	White oak	70	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar	---	
						Eastern white pine	---	
						Red pine	78	
OhB: Oshtemo	3o	Slight	Slight	Slight	Slight	Northern red oak	66	Eastern white pine, red pine.
						White oak	---	
						American basswood	66	
						Sugar maple	61	
Pe: Pewamo	2w	Slight	Severe	Severe	Severe	Pin oak	90	White ash, eastern white pine, red maple, green ash.
						Swamp white oak	---	
						Red maple	71	
						White ash	71	
						Eastern cottonwood	98	
						Green ash	---	
RaB: Rawson	2o	Slight	Slight	Slight	Slight	White oak	75	Eastern white pine, yellow-poplar, black walnut, white ash, red pine, northern red oak, white oak.
						Northern red oak	80	
						Black walnut	---	
						Black cherry	---	
						Sugar maple	---	
						White ash	---	
						Yellow-poplar	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Re----------------- Rensselaer	2w	Slight	Severe	Severe	Severe	Pin oak------------- White oak----------- Northern red oak----	86 75 76	Eastern white pine, red maple, white ash.
Se----------------- Sebewa	2w	Slight	Severe	Severe	Severe	Pin oak------------- White ash----------- White oak----------- Red maple----------- American basswood---	88 75 72 --- ---	Eastern white pine, white ash, green ash, pin oak.
SrB2, SrC2, StC3--- Strawn	2o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Black walnut--------	80 80 90 ---	White oak, black walnut, northern red oak, green ash, eastern white pine, red pine, sugar maple.
StD3--------------- Strawn	2r	Moderate	Moderate	Moderate	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Black walnut--------	80 80 90 ---	White oak, black walnut, northern red oak, green ash, eastern white pine, red pine, sugar maple.
Wa----------------- Wallkill	4w	Slight	Severe	Severe	Severe	Pin oak------------- Red maple----------- White ash----------- Quaking aspen-------	65 51 52 56	Red maple, green ash, eastern cottonwood.
Wt----------------- Whitaker	3o	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Yellow-poplar------- Northern red oak----	70 85 85 75	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
BaA, BaB2--------- Blount	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Bn---------------- Bono	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine, Norway spruce.	Pin oak.
BoB, BoC---------- Boyer	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
CrA--------------- Conover	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Em---------------- Eel	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
GnB2-------------- Glynwood	---	Amur honeysuckle, Washington hawthorn, Amur privet, arrowwood, eastern redcedar, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
HaA--------------- Haskins	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
HdB--------------- Hillsdale	---	Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, Tatarian honeysuckle.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Eastern white pine, red pine, Norway spruce.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Hw: Houghton	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow, green ash.	Golden willow, black willow.	Imperial Carolina poplar.
Ld: Landes	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Mc: Martisco	Common ninebark, whitebelle noneysuckle.	Amur honeysuckle, silky dogwood, Amur privet, nannyberry viburnum, Tatarian honey-suckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
MfB: Metea	Siberian peashrub	Eastern redcedar, radiant crabapple, lilac, Washington hawthorn, Amur honeysuckle, autumn-olive, Tatarian honeysuckle.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
MoC2, MoD2: Morley	---	Amur honeysuckle, Washington hawthorn, osageorange, Amur privet, arrowwood, American cranberrybush, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
MoE2. Morley					
MrC3, MrD3: Morley	---	Amur honeysuckle, Washington hawthorn, osageorange, Amur privet, arrowwood, American cranberrybush, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
OdB: Ormas	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
OhB: Oshtemo	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
Pe: Pewamo	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
RaB: Rawson	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, white fir, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Re: Rensselaer	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Se: Sebewa	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
SrB2, SrC2, StC3, StD3: Strawn	Northern white-cedar.	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	White fir, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Ud*. Udorthents					
Wa: Wallkill	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, silky dogwood, Amur privet, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Wt: Whitaker	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, Austrian pine, blue spruce, Washington hawthorn, northern white-cedar.	Norway spruce	Eastern white pine, pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BaA, BaB2: Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Bn: Bono	Severe: ponding, too clayey, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: too clayey, ponding.
BoB: Boyer	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
BoC: Boyer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
CrA: Conover	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Em: Eel	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
GnB2: Glynwood	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: wetness, slope, percs slowly.	Moderate: wetness.	Slight.
HaA: Haskins	Severe: wetness.	Moderate: percs slowly, wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
HdB: Hillsdale	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Hw: Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Ld: Landes	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Mc: Martisco	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
MfB: Metea	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Moderate: droughty.
MoC2: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MoD2, MoE2: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MrC3: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MrD3: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OdB: Ormas	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
OhB: Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
Pe: Pewamo	Severe: too clayey, ponding.	Severe: too clayey, ponding.	Severe: too clayey, ponding.	Severe: too clayey, ponding.	Severe: too clayey, ponding.
RaB: Rawson	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
Re: Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Se: Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
SrB2: Strawn	Slight	Slight	Moderate: slope.	Slight	Slight.
SrC2, StC3: Strawn	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
StD3: Strawn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ud*. Udorthents					
Wa: Wallkill	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding.
Wt: Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
BaA Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BaB2 Blount	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Bn Bono	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
BoB Boyer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BoC Boyer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CrA Conover	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
Em Eel	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
GnB2 Glynwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HaA Haskins	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
HdB Hillsdale	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hw Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ld Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Mc Martisco	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
MfB Metea	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MoC2 Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MoD2, MoE2 Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MrC3 Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MrD3 Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OdB Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
OhB Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Pe Pewamo	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Good.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
RaB: Rawson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Re: Rensselaer	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Se: Sebewa	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
SrB2: Strawn	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SrC2: Strawn	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
StC3: Strawn	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
StD3: Strawn	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ud*. Udorthents										
Wa: Wallkill	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wt: Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BaA, BaB2: Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Bn: Bono	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.	Severe: too clayey, ponding.
BoB: Boyer	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
BoC: Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
CrA: Conover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Em: Eel	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
GnB2: Glynwood	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: slope, shrink-swell, wetness.	Severe: frost action, low strength.	Slight.
HaA: Haskins	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
HdB: Hillsdale	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Hw: Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
Ld: Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Mc: Martisco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding, excess humus.
MfB: Metea	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: frost action, low strength.	Moderate: droughty.
MoC2: Morley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MoD2, MoE2: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
MrC3: Morley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MrD3: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OdB-----Ormas	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
OhB-----Oshtemo	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones.
Pe-----Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: too clayey, ponding.
RaB-----Rawson	Moderate: dense layer, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: frost action.	Slight.
Re-----Rensselaer	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Se-----Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
SrB2-----Strawn	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
SrC2, StC3-----Strawn	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
StD3-----Strawn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ud*. Udorthents						
Wa-----Wallkill	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: ponding.
Wt-----Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BaA, BaB2----------- Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bn----------------- Bono	Severe: percs slowly, ponding.	Slight-----------	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
BoB---------------- Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BoC---------------- Boyer	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
CrA---------------- Conover	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Em----------------- Eel	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
GnB2--------------- Glynwood	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
HaA---------------- Haskins	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
HdB---------------- Hillsdale	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Hw----------------- Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Ld----------------- Landes	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Mc----------------- Martisco	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding, excess humus.
MfB---------------- Metea	Severe: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MoC2--------------- Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MoD2, MoE2---------- Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MrC3: Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MrD3: Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
OdB: Ormas	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
OhB: Oshtemo	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Pe: Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
RaB: Rawson	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, wetness.	Moderate: wetness.	Fair: too clayey, wetness.
Re: Rensselaer	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Se: Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
SrB2: Strawn	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
SrC2, StC3: Strawn	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
StD3: Strawn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ud*. Udorthents					
Wa: Wallkill	Severe: ponding.	Severe: ponding, seepage, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Wt: Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BaA, BaB2: Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Bn: Bono	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
BoB, BoC: Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
CrA: Conover	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Em: Eel	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
GnB2: Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
HaA: Haskins	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
HdB: Hillsdale	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Hw: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Ld: Landes	Good	Probable	Improbable: too sandy.	Poor: thin layer.
Mc: Martisco	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
MfB: Metea	Poor: thin layer, low strength.	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
MoC2: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MoD2, MoE2: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
MrC3: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MrD3: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
OdB: Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
OhB: Oshtemo	Good	Probable	Probable	Poor: small stones.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pe: Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
RaB: Rawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
Re: Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Se: Sebewa	Poor: wetness.	Probable	Probable	Poor: wetness, small stones, area reclaim.
SrB2, SrC2, StC3: Strawn	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey.
StD3: Strawn	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ud*. Udorthents				
Wa: Wallkill	Poor: low strength, wetness, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
Wt: Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
BaA Blount	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
BaB2 Blount	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Bn Bono	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
BoB Boyer	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
BoC Boyer	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
CrA Conover	Slight	Severe: piping, wetness.	Severe: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
Em Eel	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
GnB2 Glynwood	Moderate: slope.	Moderate: wetness, piping.	Severe: no water.	Slope, percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
HaA Haskins	Moderate: seepage.	Moderate: wetness, piping.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
HdB Hillsdale	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
Hw Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Wetness.
Ld Landes	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Too sandy, soil blowing.	Droughty.
Mc Martisco	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Percs slowly, ponding, frost action.	Ponding, percs slowly, soil blowing.	Wetness, percs slowly.
MfB Metea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
MoC2, MoD2, MoE2, MrC3, MrD3 Morley	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
OdB Ormas	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, too sandy.	Droughty.
OhB Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Favorable.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Pe----------------- Pewamo	Slight----------	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding---------	Wetness.
RaB---------------- Rawson	Moderate: seepage, slope.	Moderate: wetness, piping.	Severe: no water.	Percs slowly, slope.	Wetness, soil blowing.	Percs slowly.
Re----------------- Rensselaer	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, frost action.	Ponding, too sandy.	Wetness, percs slowly.
Se----------------- Sebewa	Severe: seepage.	Severe: seepage, ponding, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave, ponding.	Too sandy, soil blowing, ponding.	Wetness.
SrB2--------------- Strawn	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
SrC2, StC3, StD3-- Strawn	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Ud* Udorthents						
Wa----------------- Wallkill	Severe: seepage.	Severe: excess humus, ponding, piping.	Moderate: slow refill.	Ponding, frost action, subsides.	Ponding---------	Wetness.
Wt----------------- Whitaker	Severe: seepage.	Severe: wetness, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Erodes easily, wetness.	Wetness, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BaA, BaB2-------- Blount	0-9	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	9-25	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	90-100	80-95	35-60	15-35
	25-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
Bn--------------- Bono	0-10	Silty clay-------	CH, CL	A-7	0	100	98-100	95-100	80-95	40-60	20-35
	10-58	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	98-100	95-100	90-100	40-66	26-44
	58-60	Silty clay loam, silty clay.	CL	A-7, A-6	0	100	98-100	95-100	90-100	30-45	15-30
BoB, BoC--------- Boyer	0-10	Sandy loam-------	SM, SM-SC	A-2, A-4	0-5	95-100	75-95	60-75	25-40	<25	NP-7
	10-31	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	31-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
CrA-------------- Conover	0-9	Loam-------------	ML, CL, CL-ML	A-4	0-5	95-100	90-100	80-95	55-90	20-30	3-10
	9-28	Clay loam, silty clay loam, loam.	CL	A-6	0-5	95-100	90-100	80-95	50-90	29-40	15-25
	28-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-95	50-75	25-34	6-14
Em--------------- Eel	0-9	Loam-------------	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	9-39	Silt loam, loam	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	39-60	Stratified sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	100	90-100	70-80	55-70	26-40	3-15
GnB2------------- Glynwood	0-9	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	55-90	23-40	4-15
	9-21	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	21-60	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-18
HaA-------------- Haskins	0-9	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	85-100	70-100	55-90	25-40	5-20
	9-28	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A-6, A-4, A-2	0	85-100	70-100	55-85	30-65	20-40	7-20
	28-60	Silty clay loam, clay loam.	CL	A-7, A-6	0	100	85-100	80-100	70-95	35-50	15-26
HdB-------------- Hillsdale	0-10	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0-5	95-100	80-100	60-90	20-65	<25	2-10
	10-47	Fine sandy loam, sandy clay loam, loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0-5	95-100	80-100	65-85	30-50	20-30	2-12
	47-60	Fine sandy loam, loamy sand.	SM, SC, SM-SC	A-2-4, A-4	0-5	95-100	80-100	55-80	25-40	<22	3-8
Hw--------------- Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
Ld--------------- Landes	0-12	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	95-100	85-95	20-50	<25	NP-10
	12-60	Stratified fine sand to silt loam.	SM, ML, SP-SM, SC	A-2, A-4	0	100	95-100	60-95	10-70	<30	NP-10
Mc--------------- Martisco	0-10	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	10-60	Marl-------------	---	---	0	---	---	---	---	---	---

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
MfB--------------- Metea	0-9	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	9-29	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	10-35	---	NP
	29-35	Clay loam, sandy loam, silty clay loam.	CL, SC	A-6, A-7, A-4	0	90-100	90-95	50-95	25-75	20-50	8-30
	35-60	Loam, clay, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-3	85-95	80-90	75-90	50-75	25-45	5-22
MoC2, MoD2, MoE2- Morley	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	8-13	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	13-25	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	25-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
MrC3, MrD3------- Morley	0-7	Silty clay loam	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
	7-22	Silty clay, silty clay loam.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	22-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
OdB-------------- Ormas	0-38	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	38-53	Sandy loam-------	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	53-55	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-80	55-80	35-70	20-45	20-40	6-20
	55-60	Gravelly sand----	SP, SP-SM	A-3, A-1-B, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
OhB-------------- Oshtemo	0-12	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	12-47	Fine sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	47-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
Pe--------------- Pewamo	0-10	Silty clay-------	CH	A-7	0-5	90-100	80-100	80-100	75-95	50-55	25-30
	10-34	Clay loam, clay, silty clay.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	34-60	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
RaB-------------- Rawson	0-13	Sandy loam-------	SM, ML	A-2-4, A-4	0	90-100	80-100	50-85	25-55	<30	NP-5
	13-39	Clay loam, sandy loam, gravelly loam.	SC, CL	A-4, A-6	0	65-100	55-95	45-90	25-75	20-40	7-20
	39-60	Clay, silty clay, silty clay loam, clay loam.	CH, CL	A-7, A-6	0	90-100	85-100	85-100	75-95	35-50	15-26
Re--------------- Rensselaer	0-14	Loam-------------	CL, ML	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	14-41	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	80-100	60-80	33-47	15-26
	41-46	Sandy loam-------	CL, SC	A-6	0	95-100	90-100	75-95	35-55	25-35	11-16
	46-60	Stratified fine sand to clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-2	0	95-100	90-100	60-95	20-70	<30	4-9

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Se----------------- Sebewa	0-11	Sandy loam-------	SM, SM-SC	A-2-4, A-4	0	95-100	80-100	55-70	25-40	<25	NP-6
	11-25	Sandy clay loam, loam, gravelly clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	25-60	Gravelly sand, loamy sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
SrB2, SrC2------- Strawn	0-8	Loam-------------	CL, ML, CL-ML	A-4, A-6	0	95-100	95-100	90-100	90-100	20-40	3-20
	8-23	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0-5	90-100	80-100	75-95	50-95	25-45	10-23
	23-60	Loam, silt loam, clay loam.	CL, SC	A-4, A-6	0-5	75-100	70-100	60-95	40-95	20-35	7-18
StC3, StD3------- Strawn	0-7	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-100	75-95	50-95	25-45	10-23
	7-19	Silty clay loam, clay loam.	CL	A-6, A-7	0-5	90-100	80-100	75-95	50-95	25-45	10-23
	19-60	Loam, silt loam, clay loam.	CL, SC	A-4, A-6	0-5	75-100	70-100	60-95	40-95	20-35	7-18
Ud*. Udorthents											
Wa----------------- Wallkill	0-9	Silt loam--------	ML, SM, OL	A-5, A-7	0	95-100	90-100	70-100	40-90	40-50	5-15
	9-20	Silt loam, loam, gravelly silt loam.	CL, CL-ML, SM-SC, SC	A-4	0	75-100	70-100	60-100	40-90	15-25	5-10
	20-60	Sapric material, hemic material.	Pt	A-8	0	---	---	---	---	---	---
Wt----------------- Whitaker	0-11	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	11-28	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-47	12-26
	28-60	Stratified sand to silt loam.	ML, SM, CL-ML, SM-SC	A-4, A-2	0	95-100	95-100	45-100	15-90	<25	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
BaA, BaB2	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low	0.43	3	6	2-3
Blount	9-25	35-50	1.40-1.70	0.06-0.2	0.12-0.19	4.5-6.5	Moderate	0.43			
	25-60	27-38	1.60-1.85	0.06-0.2	0.07-0.10	7.4-8.4	Moderate	0.43			
Bn	0-10	35-45	1.20-1.45	0.2-2.0	0.20-0.23	6.1-7.3	High	0.28	5	4	4-8
Bono	10-58	40-55	1.35-1.55	<0.2	0.10-0.14	6.1-8.4	High	0.28			
	58-60	27-45	1.45-1.60	<0.2	0.08-0.12	7.4-8.4	High	0.28			
BoB, BoC	0-10	5-15	1.15-1.60	2.0-6.0	0.10-0.15	5.6-7.3	Low	0.24	4-3	3	.5-3
Boyer	10-31	10-18	1.25-1.60	2.0-6.0	0.12-0.18	5.6-7.8	Low	0.24			
	31-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low	0.10			
CrA	0-9	11-22	1.40-1.55	0.6-2.0	0.18-0.24	5.6-6.5	Low	0.28	5	5	4-6
Conover	9-28	25-35	1.45-1.65	0.2-0.6	0.15-0.18	5.6-7.3	Moderate	0.28			
	28-60	15-32	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Low	0.37			
Em	0-9	18-27	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.8	Low	0.37	5	5	1-3
Eel	9-39	18-27	1.30-1.50	0.6-2.0	0.17-0.22	6.1-8.4	Low	0.37			
	39-60	10-27	1.30-1.50	0.6-2.0	0.19-0.21	7.4-8.4	Low	0.37			
GnB2	0-9	16-27	1.25-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.43	3	6	1-3
Glynwood	9-21	35-55	1.45-1.75	0.06-0.2	0.11-0.18	5.6-8.4	Moderate	0.32			
	21-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate	0.32			
HaA	0-9	12-20	1.30-1.45	0.6-2.0	0.18-0.22	6.1-7.3	Low	0.37	4	5	1-4
Haskins	9-28	18-35	1.45-1.70	0.6-2.0	0.12-0.16	6.1-7.3	Low	0.37			
	28-60	27-36	1.60-1.80	0.06-0.2	0.08-0.12	6.1-8.4	Moderate	0.37			
HdB	0-10	2-15	1.10-1.60	0.6-6.0	0.13-0.22	5.6-7.3	Low	0.24	5	3	1-3
Hillsdale	10-47	10-22	1.25-1.70	2.0-6.0	0.12-0.18	4.5-7.3	Low	0.24			
	47-60	0-15	1.30-1.95	2.0-6.0	0.08-0.13	7.9-8.4	Low	0.24			
Hw	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	---	1	>70
Houghton											
Ld	0-12	5-20	1.40-1.60	2.0-6.0	0.10-0.18	6.1-8.4	Low	0.20	5	3	1-3
Landes	12-60	8-18	1.60-1.80	2.0-20	0.05-0.15	6.1-8.4	Low	0.20			
Mc	0-10	---	0.13-0.23	0.6-6.0	0.35-0.45	6.1-8.4	-------------	----	---	2	>25
Martisco	10-60	---	---	0.06-0.2	---	7.9-8.4	Low	----			
MfB	0-9	3-8	1.45-1.60	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	.5-2
Metea	9-29	2-10	1.50-1.70	6.0-20	0.06-0.11	5.1-7.3	Low	0.17			
	29-35	15-35	1.50-1.70	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	0.32			
	35-60	20-42	1.60-1.80	0.06-0.2	0.07-0.12	6.6-8.4	Moderate	0.43			
MoC2, MoD2, MoE2	0-8	16-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low	0.43	3	6	1-3
Morley	8-13	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate	0.43			
	13-25	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate	0.43			
	25-60	27-40	1.60-1.80	0.06-0.2	0.07-0.12	7.4-8.4	Moderate	0.43			
MrC3, MrD3	0-7	27-35	1.40-1.60	0.2-0.6	0.18-0.22	5.1-6.5	Moderate	0.43	2	7	1-3
Morley	7-22	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate	0.43			
	22-60	27-40	1.60-1.80	0.06-0.2	0.07-0.12	7.4-8.4	Moderate	0.43			
OdB	0-38	5-12	1.40-1.60	2.0-6.0	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
Ormas	38-53	10-20	1.50-1.70	2.0-6.0	0.12-0.14	5.1-6.5	Low	0.17			
	53-55	18-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low	0.32			
	55-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low	0.15			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
OhB-------------- Oshtemo	0-12 12-47 47-60	2-10 10-18 0-15	1.20-1.60 1.20-1.60 1.20-1.50	2.0-6.0 2.0-6.0 >20	0.10-0.15 0.12-0.19 0.02-0.04	5.1-7.3 5.1-6.5 7.4-8.4	Low----------- Low----------- Low-----------	0.24 0.24 0.10	5	3	.5-3
Pe--------------- Pewamo	0-10 10-34 34-60	40-45 35-50 27-40	1.35-1.55 1.40-1.70 1.50-1.75	0.2-0.6 0.2-0.6 0.2-0.6	0.12-0.20 0.12-0.20 0.14-0.18	6.1-7.3 5.6-7.8 7.4-8.4	Moderate----- Moderate----- Moderate-----	0.24 0.24 0.24	5	4	3-5
RaB-------------- Rawson	0-13 13-39 39-60	9-18 18-35 30-36	1.30-1.45 1.50-1.69 1.60-1.82	0.6-2.0 0.6-2.0 0.06-0.2	0.12-0.18 0.12-0.16 0.08-0.12	4.5-7.3 5.1-7.3 6.6-8.4	Low----------- Low----------- Moderate-----	0.24 0.32 0.32	4-3	3	.5-3
Re--------------- Rensselaer	0-14 14-41 41-46 46-60	18-27 27-35 25-35 2-30	1.30-1.45 1.40-1.60 1.40-1.60 1.50-1.70	0.2-0.6 0.06-0.2 0.06-0.2 0.6-2.0	0.20-0.24 0.15-0.19 0.16-0.18 0.19-0.21	6.1-7.3 6.1-7.3 7.4-8.4 7.9-8.4	Low----------- Moderate----- Moderate----- Low-----------	0.28 0.28 0.28 0.28	5	5	2-6
Se--------------- Sebewa	0-11 11-25 25-60	5-20 18-35 0-3	1.15-1.60 1.50-1.80 1.55-1.75	0.6-2.0 0.6-2.0 6.0-20	0.12-0.15 0.15-0.19 0.02-0.04	6.1-7.8 6.1-7.8 7.4-8.4	Low----------- Low----------- Low-----------	0.24 0.24 0.10	4	3	4-7
SrB2, SrC2------- Strawn	0-8 8-23 23-60	10-27 27-35 16-30	1.15-1.45 1.35-1.55 1.50-1.70	0.6-2.0 0.6-2.0 0.6-2.0	0.20-0.24 0.15-0.20 0.08-0.12	6.1-7.3 5.6-7.8 7.4-8.4	Low----------- Moderate----- Low-----------	0.37 0.37 0.37	4	6	1-3
StC3, StD3------- Strawn	0-7 7-19 19-60	27-30 27-35 16-30	1.35-1.55 1.35-1.55 1.50-1.70	0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.15-0.20 0.08-0.12	5.6-6.5 5.6-7.8 7.4-8.4	Moderate----- Moderate----- Low-----------	0.37 0.37 0.37	3	7	1-2
Ud*. Udorthents											
Wa--------------- Wallkill	0-9 9-20 20-60	10-27 15-27 ---	1.15-1.40 1.15-1.45 0.25-0.45	0.6-2.0 0.6-2.0 2.0-6.0	0.16-0.21 0.15-0.20 0.35-0.45	5.1-7.8 5.1-7.8 5.6-7.8	Low----------- Low----------- -------------	0.32 0.32 ----	5	---	4-12
Wt--------------- Whitaker	0-11 11-28 28-60	8-17 18-30 3-18	1.30-1.45 1.40-1.60 1.50-1.70	0.6-2.0 0.6-2.0 0.6-6.0	0.20-0.24 0.15-0.19 0.15-0.21	5.6-7.3 5.1-6.0 6.6-8.4	Low----------- Moderate----- Low-----------	0.37 0.37 0.37	5	5	1-3

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
BaA, BaB2 Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	High	High	High.
Bn Bono	B/D	None	---	---	+1-1.0	Apparent	Dec-May	Moderate	High	Low.
BoB, BoC Boyer	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
CrA Conover	B	None	---	---	1.0-2.0	Apparent	Nov-May	High	High	Moderate.
Em Eel	C	Frequent	Brief	Oct-Jun	3.0-6.0	Apparent	Jan-Apr	High	Moderate	Low.
GnB2 Glynwood	C	None	---	---	2.0-3.5	Perched	Jan-Apr	High	High	Moderate.
HaA Haskins	C	None	---	---	1.0-2.5	Perched	Jan-Apr	High	High	Moderate.
HdB Hillsdale	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
Hw Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	High	High	Low.
Ld Landes	B	Frequent	Brief	Oct-Jun	4.0-6.0	Apparent	Mar-May	Moderate	Low	Low.
Mc Martisco	D	None	---	---	+1-0.5	Apparent	Oct-Jun	High	High	Low.
MfB Metea	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
MoC2, MoD2, MoE2, MrC3, MrD3 Morley	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
OdB Ormas	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
OhB Oshtemo	B	None	---	---	>6.0	---	---	Low	Low	Moderate.
Pe Pewamo	C/D	None	---	---	+1-1.0	Apparent	Dec-May	High	High	Low.
RaB Rawson	B	None	---	---	2.5-6.0	Perched	Jan-Apr	Moderate	High	Moderate.
Re Rensselaer	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	High	High	Low.
Se Sebewa	B/D	None	---	---	+1-1.0	Apparent	Sep-May	High	High	Low.
SrB2, SrC2, StC3, StD3 Strawn	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ud*. Udorthents										
Wa----------------- Wallkill	D	None---------	---	---	+.5-0.5	Apparent	Sep-Jun	High-----	High-----	Moderate.
Wt----------------- Whitaker	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING TEST DATA

Soil name and location	Parent material	Report number	Depth	Moisture density: Maximum dry	Moisture density: Optimum moisture	Grain-size distribution: Percentage passing sieve--: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO	Classification: Unified
			In	Lb/cu ft	Pct									Pct			
Morley silt loam: northeast corner sec. 14, T. 35 N., R. 12 E.	Glacial till	S75IN033															
		1-1	0-8	106	16	98	96	91	69	62	48	27	18	32	8	A-4(4)	ML
		1-4	19-25	102	21	99	98	95	82	77	70	55	44	44	24	A-7-6 (20)	CL
		1-6	30-60	114	16	98	96	91	79	74	64	43	29	32	17	A-6(12)	CL
Blount silt loam: northeast corner sec. 25, T. 33 N., R. 14 E.	Glacial till	S76IN033															
		2-1	0-9	104	19	100	99	93	77	70	55	33	21	33	10	A-4(7)	CL
		2-3	16-25	103	21	100	99	96	87	81	72	54	42	45	22	A-7-6 (20)	CL
		2-5	35-60	111	17	99	97	93	83	78	67	47	34	34	15	A-6(12)	CL

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Blount	Fine, illitic, mesic Aeric Ochraqualfs
*Bono	Fine, illitic, mesic Typic Haplaquolls
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Conover	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Eel	Fine-loamy, mixed, nonacid, mesic Aquic Udifluvents
Glynwood	Fine, illitic, mesic Aquic Hapludalfs
*Haskins	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Hillsdale	Coarse-loamy, mixed, mesic Typic Hapludalfs
Houghton	Euic, mesic Typic Medisaprists
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
*Metea	Loamy, mixed, mesic Arenic Hapludalfs
Morley	Fine, illitic, mesic Typic Hapludalfs
*Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
*Pewamo	Fine, mixed, mesic Typic Argiaquolls
*Rawson	Fine-loamy, mixed, mesic Typic Hapludalfs
Rensselaer	Fine-loamy, mixed, mesic Typic Argiaquolls
*Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Strawn	Fine-loamy, mixed, mesic Typic Hapludalfs
Udorthents	Loamy, mixed, nonacid, mesic Udorthents
Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs

* The soil is a taxadjunct to the series. See text for description of those characteristics of the soil that are outside the range of the series.

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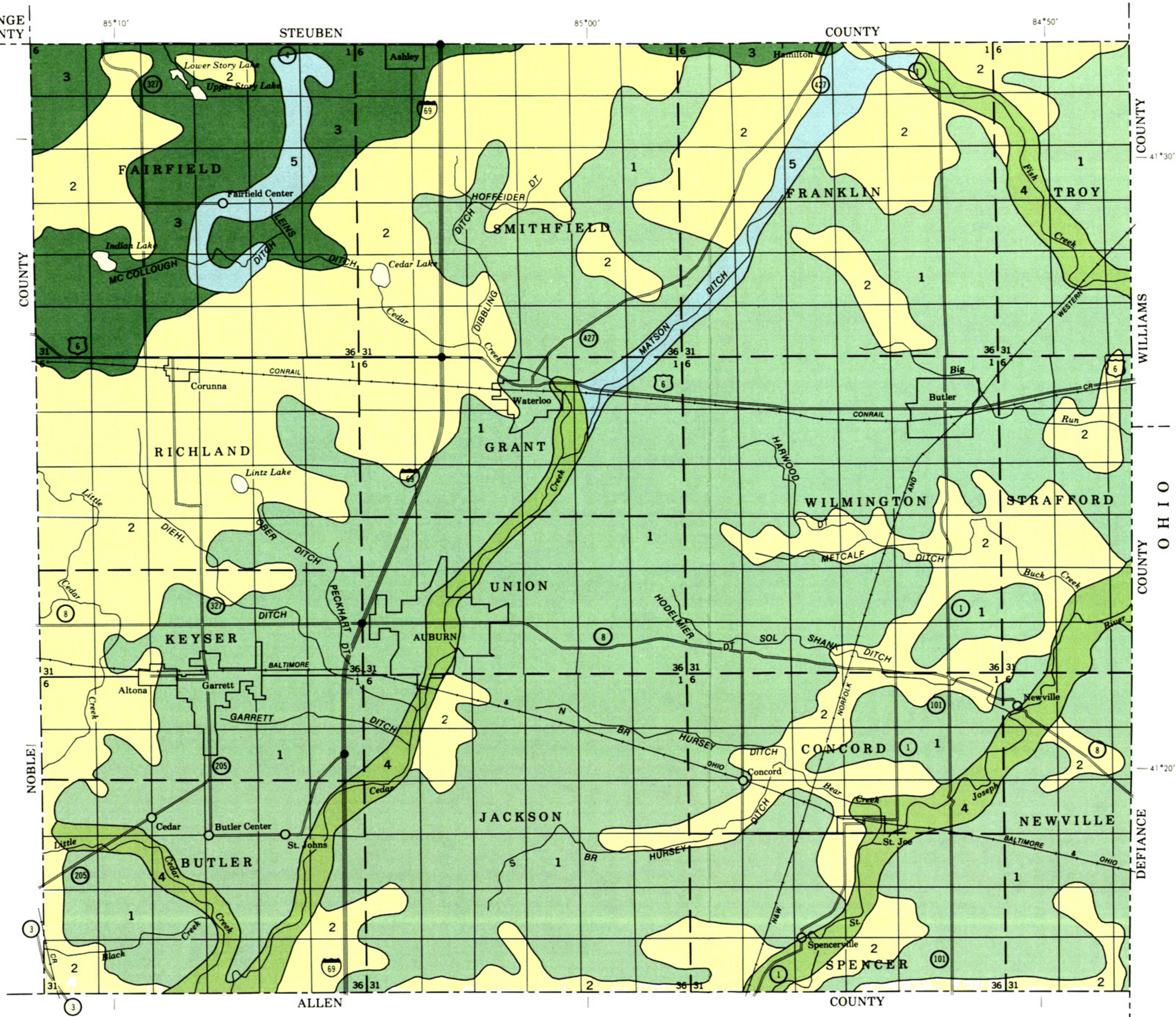
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES
SOIL AND WATER CONSERVATION COMMITTEE

GENERAL SOIL MAP

DEKALB COUNTY, INDIANA

Scale 1:126,720



N

Scale: 1 0 1 2 3 4 Miles; 1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND*

1. Blount-Pewamo-Glynwood: Deep, moderately well drained to very poorly drained, nearly level and gently sloping, silty, clayey, and loamy soils; on till plains and moraines
2. Glynwood-Pewamo-Morley: Deep, moderately well drained, very poorly drained, and well drained, nearly level to steep, loamy, clayey, and silty soils; on till plains and moraines
3. Strawn-Conover: Deep, well drained and somewhat poorly drained, nearly level to strongly sloping, loamy soils; on moraines
4. Boyer-Landes-Sebewa: Deep, well drained, moderately well drained, and very poorly drained, nearly level to moderately sloping, loamy soils underlain by sand and gravel; on terraces, outwash plains, moraines, and flood plains
5. Boyer-Sebewa-Oshtemo: Deep, well drained and very poorly drained, nearly level to moderately sloping, loamy soils underlain by sand and gravel; on terraces, outwash plains, and moraines

*The texture given in the descriptive heading refers to the texture of the surface layer of the major soils in each map unit.

Compiled 1981

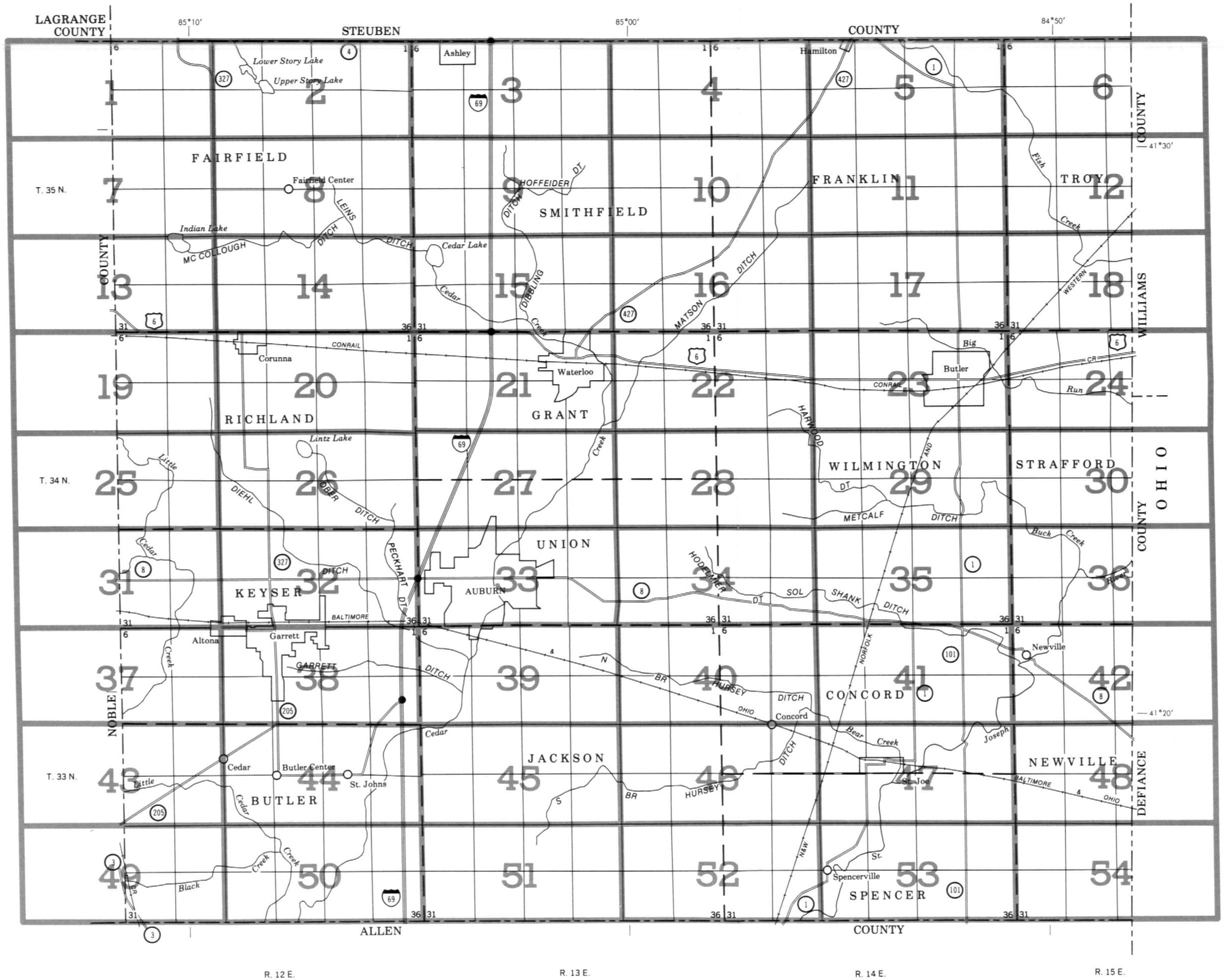
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
DEKALB COUNTY, INDIANA

Scale 1:126,720



N

1 Miles 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — Re; CrA

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

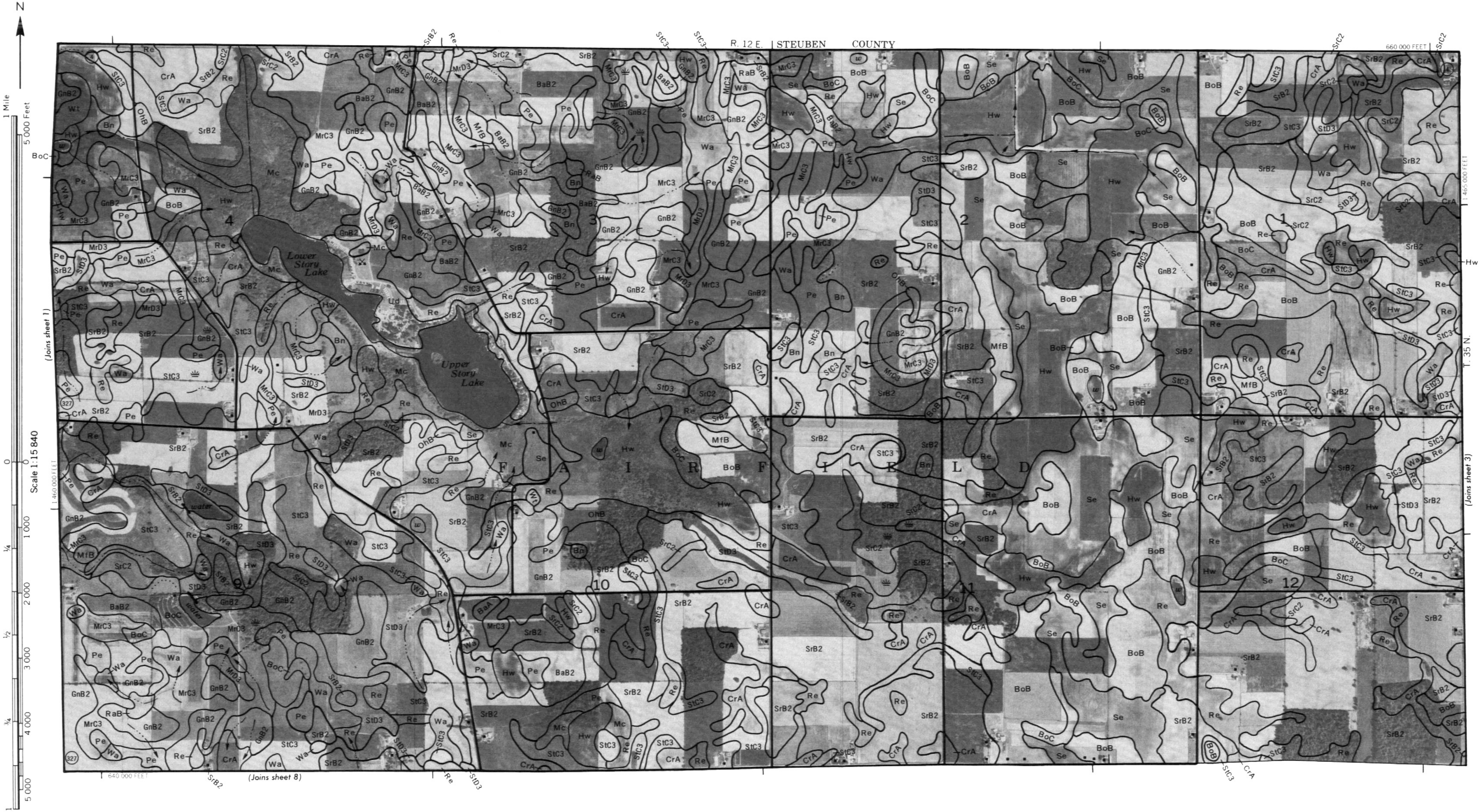
SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

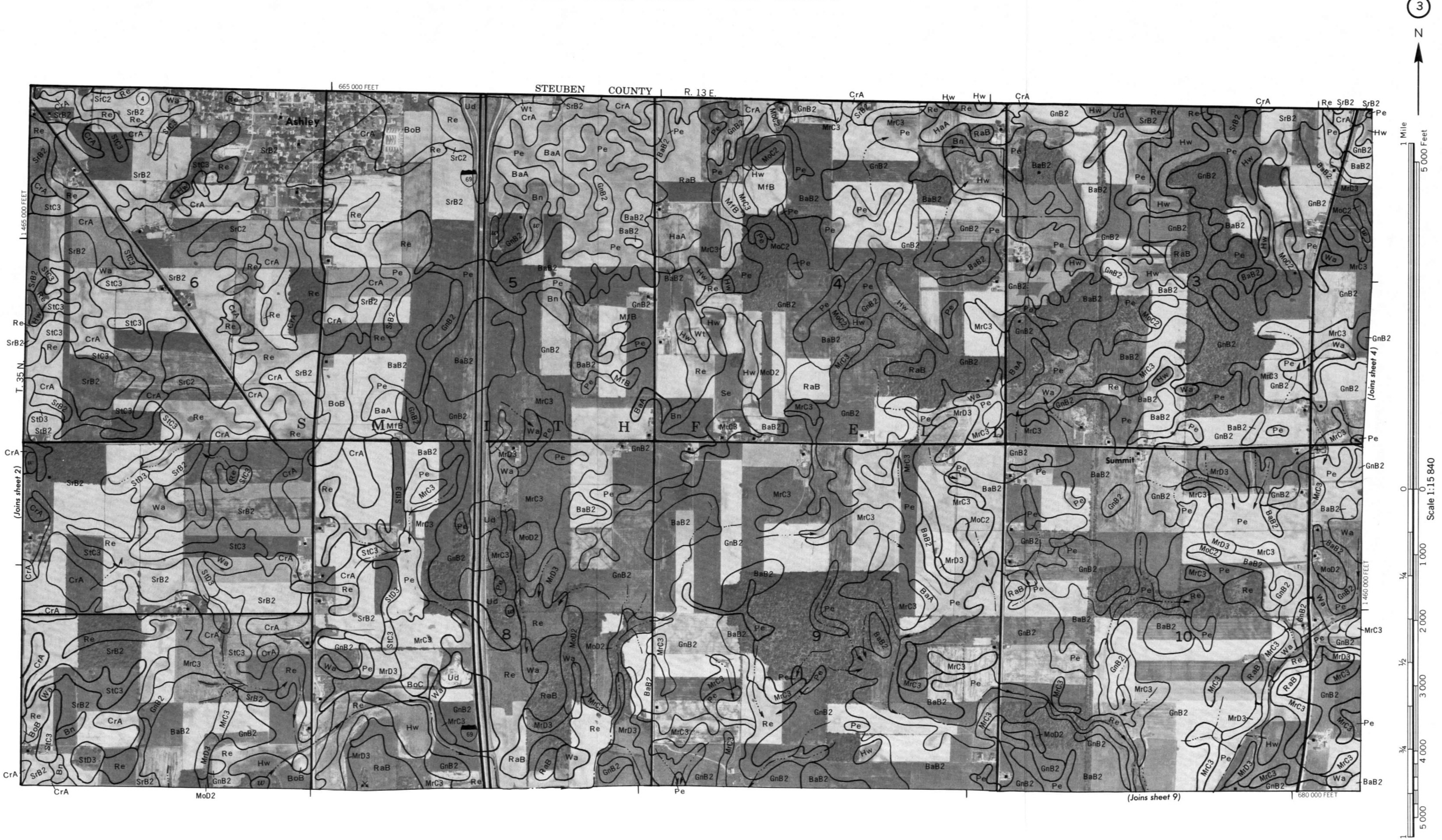
SYMBOL	NAME
BaA	Blount silt loam, 0 to 2 percent slopes
BaB2	Blount silt loam, 1 to 4 percent slopes, eroded
Bn	Bono silty clay
BoB	Boyer sandy loam, 0 to 6 percent slopes
BoC	Boyer sandy loam, 6 to 12 percent slopes
CrA	Conover loam, 0 to 3 percent slopes
Em	Eel loam, frequently flooded
GnB2	Glynwood loam, 3 to 6 percent slopes, eroded
HaA	Haskins loam, 0 to 3 percent slopes
HdB	Hillsdale fine sandy loam, 2 to 10 percent slopes
Hw	Houghton muck, drained
Ld	Landes fine sandy loam, frequently flooded
Mc	Martisco muck, undrained
MfB	Metea loamy sand, 2 to 6 percent slopes
MoC2	Morley silt loam, 6 to 12 percent slopes, eroded
MoD2	Morley silt loam, 12 to 18 percent slopes, eroded
MoE2	Morley silt loam, 18 to 30 percent slopes, eroded
MrC3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded
MrD3	Morley silty clay loam, 12 to 18 percent slopes, severely eroded
OdB	Ormas loamy sand, 0 to 6 percent slopes
OhB	Oshtemo sandy loam, 0 to 6 percent slopes
Pe	Pewamo silty clay
RaB	Rawson sandy loam, 2 to 6 percent slopes
Re	Rensselaer loam
Se	Sebewa sandy loam
SrB2	Strawn loam, 2 to 6 percent slopes, eroded
SrC2	Strawn loam, 6 to 12 percent slopes, eroded
StC3	Strawn clay loam, 6 to 12 percent slopes, severely eroded
StD3	Strawn clay loam, 12 to 18 percent slopes, severely eroded
Ud	Udorthents, loamy
Wa	Wallkill silt loam
Wt	Whitaker silt loam


1
N
R. 12 E.
STEUBEN COUNTY
NOBLE COUNTY
T. 35 N.
620 000 FEET
1 465 000 FEET
1 460 000 FEET
635 000 FEET
FAIRFIELD
(Joins sheet 2)
(Joins sheet 7)
Scale 1:15 840
1 Mile
5 000 Feet
DEKALB COUNTY, INDIANA NO. 1
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 2



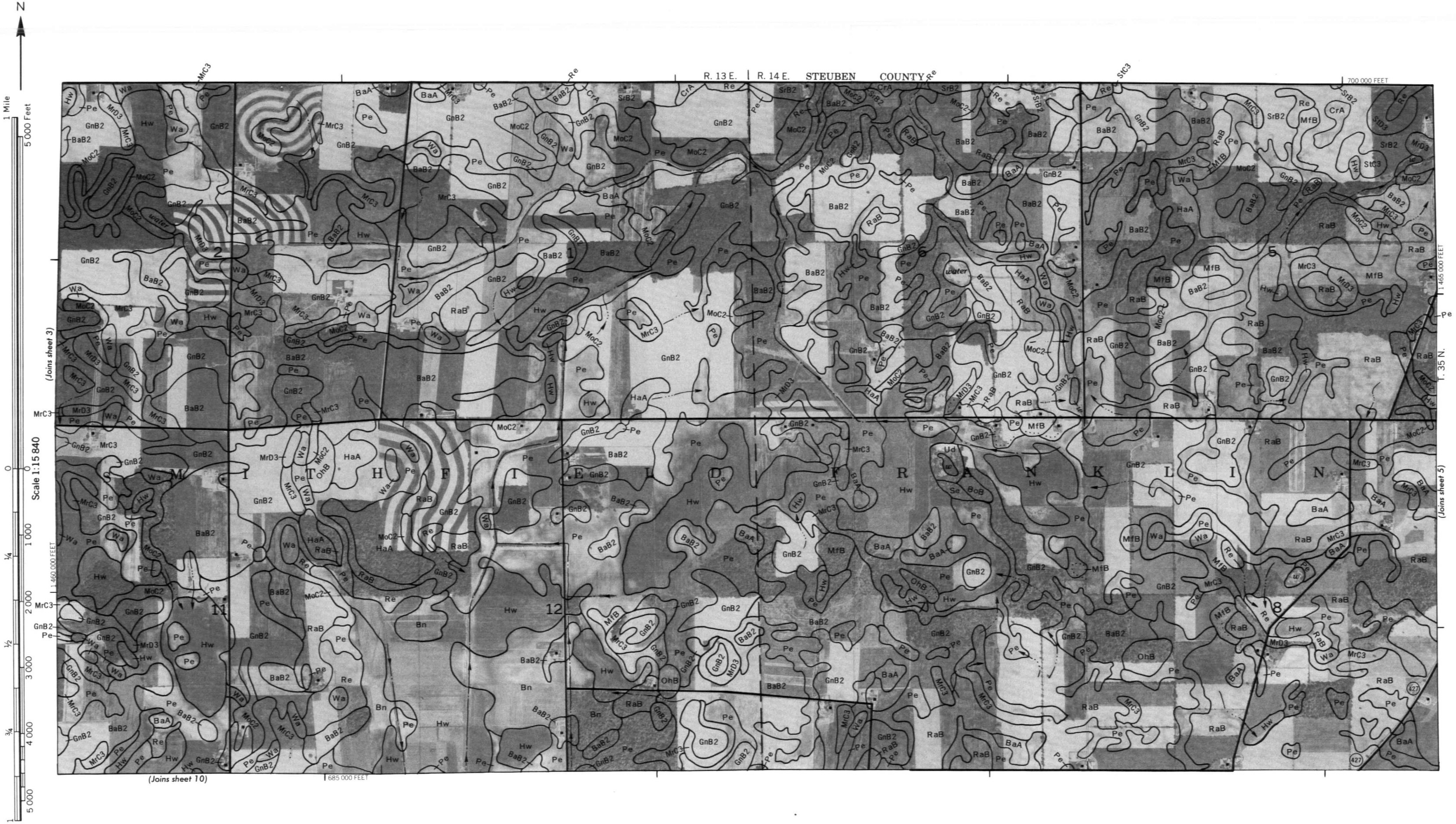
DEKALB COUNTY, INDIANA NO. 2



DEKALB COUNTY, INDIANA NO. 3

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 4

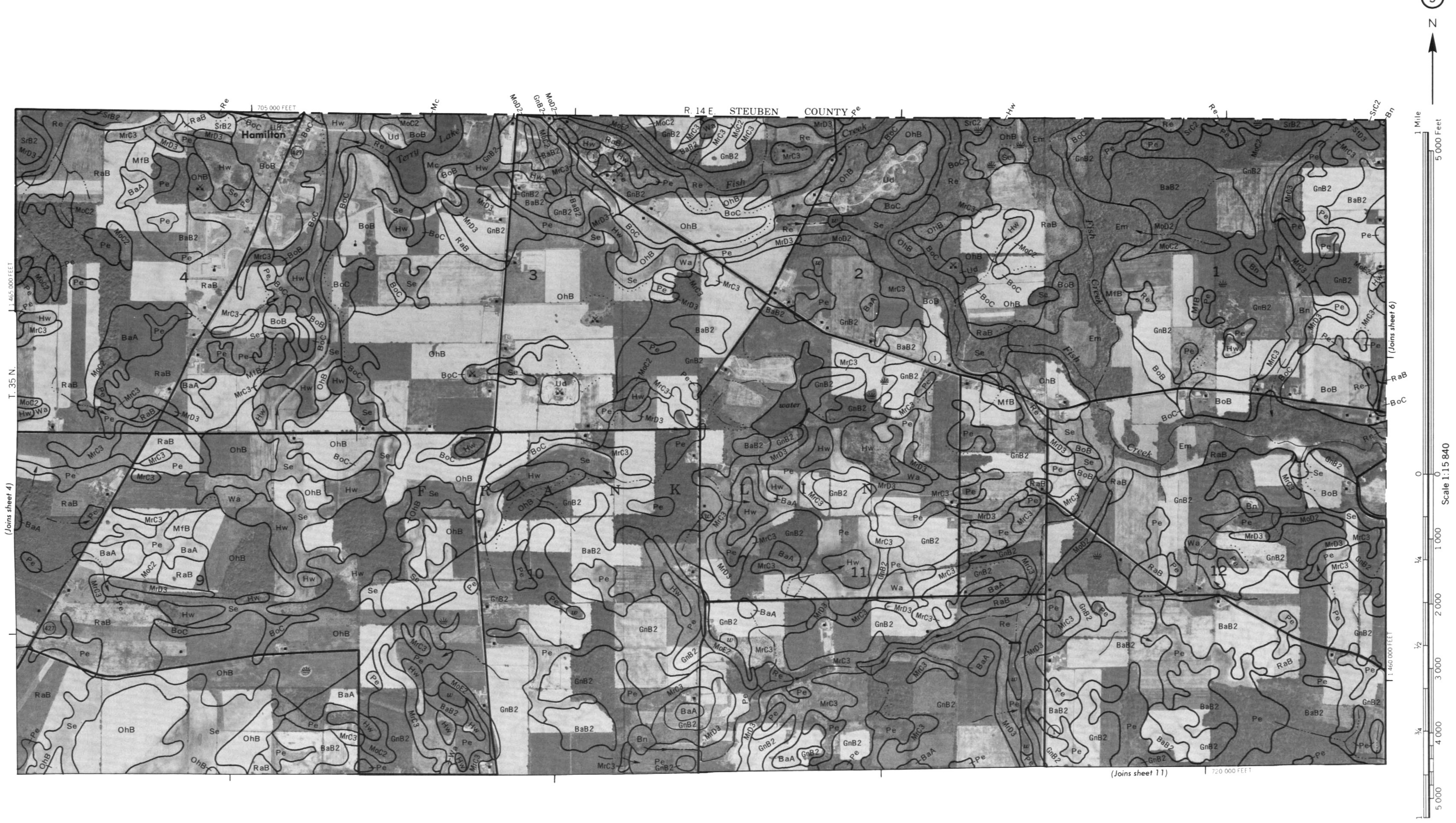


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 4

DEKALB COUNTY, INDIANA NO. 5

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



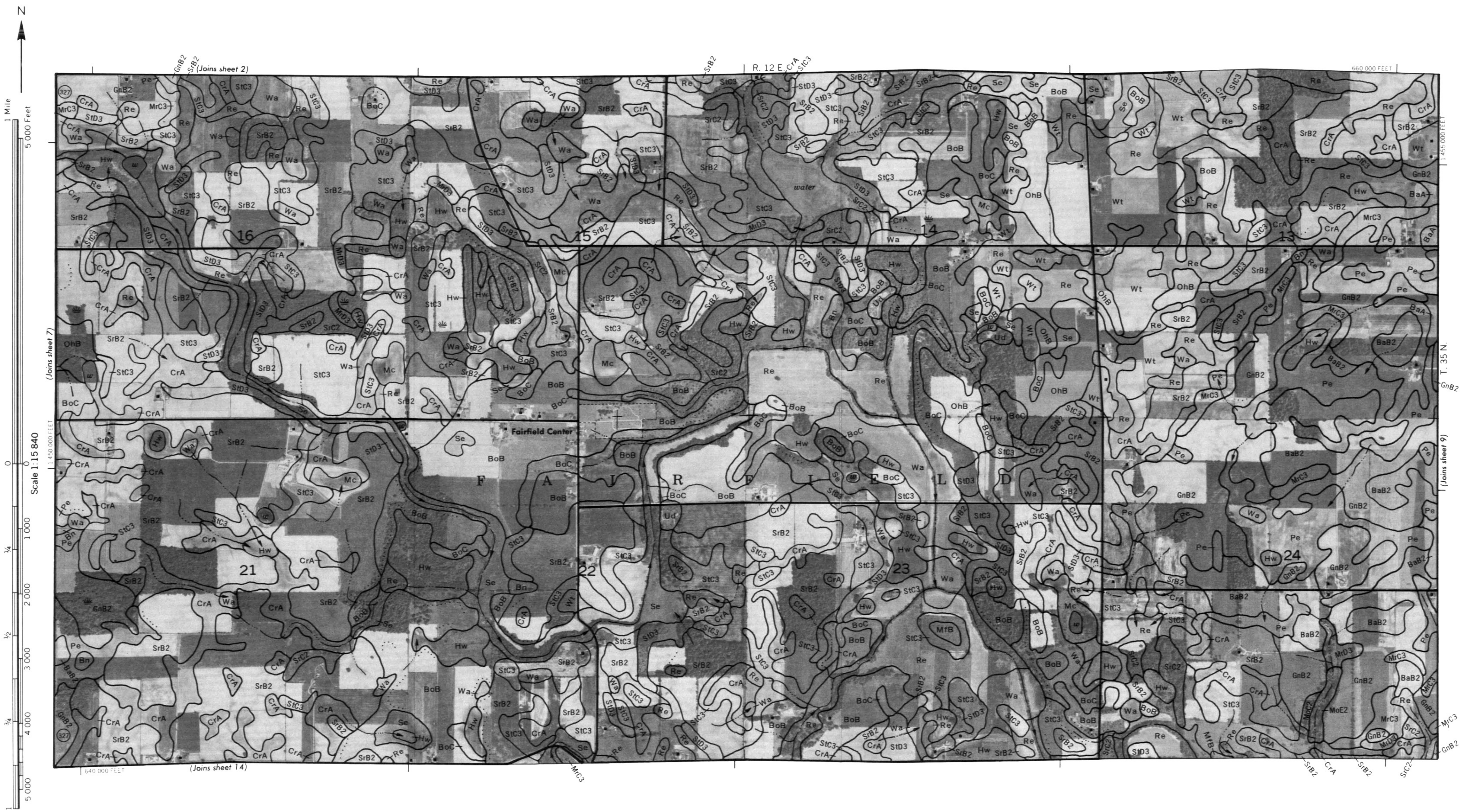
6

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 7

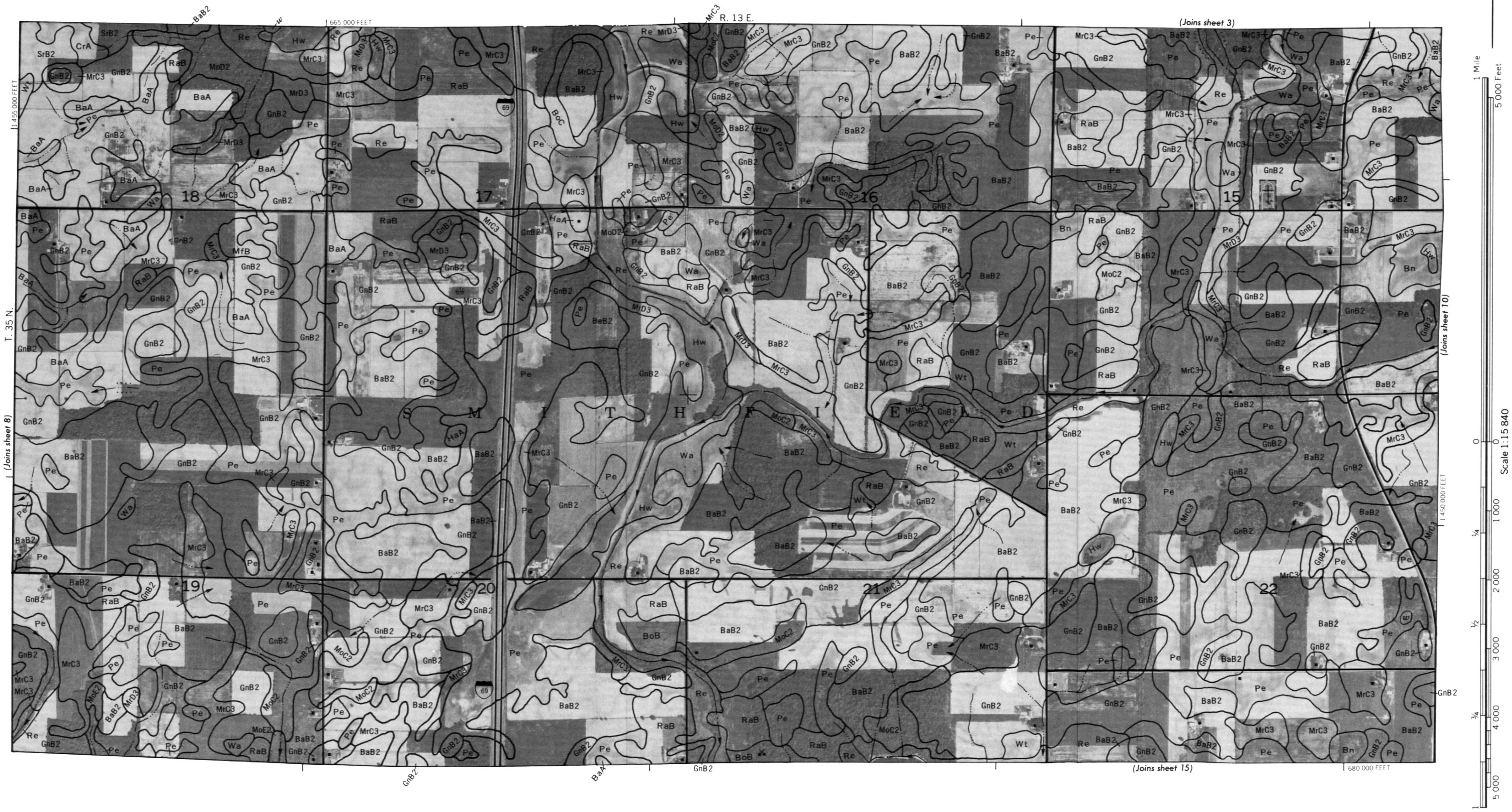
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 8



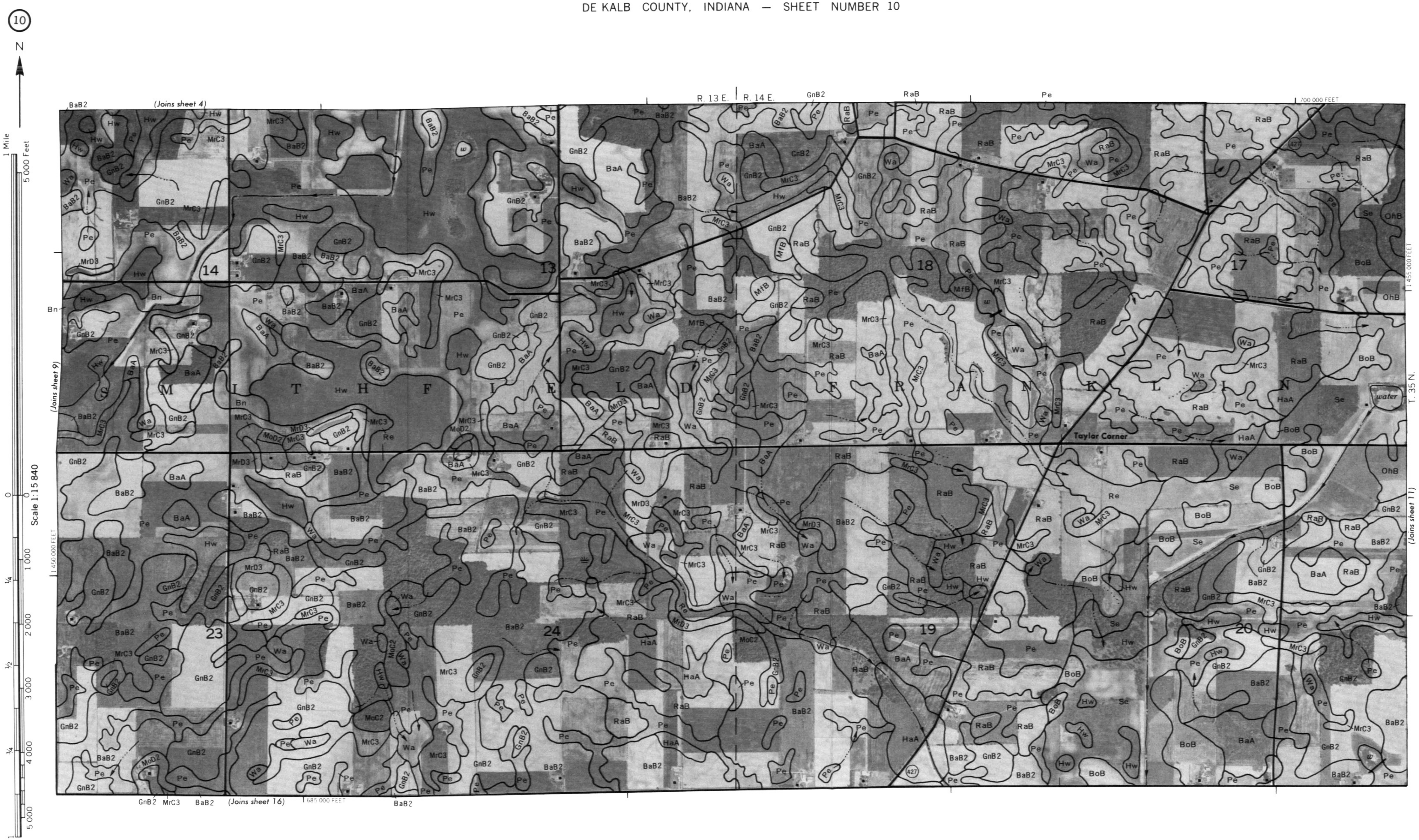
DEKALB COUNTY, INDIANA NO. 8

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



DEKALB COUNTY, INDIANA NO. 9

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

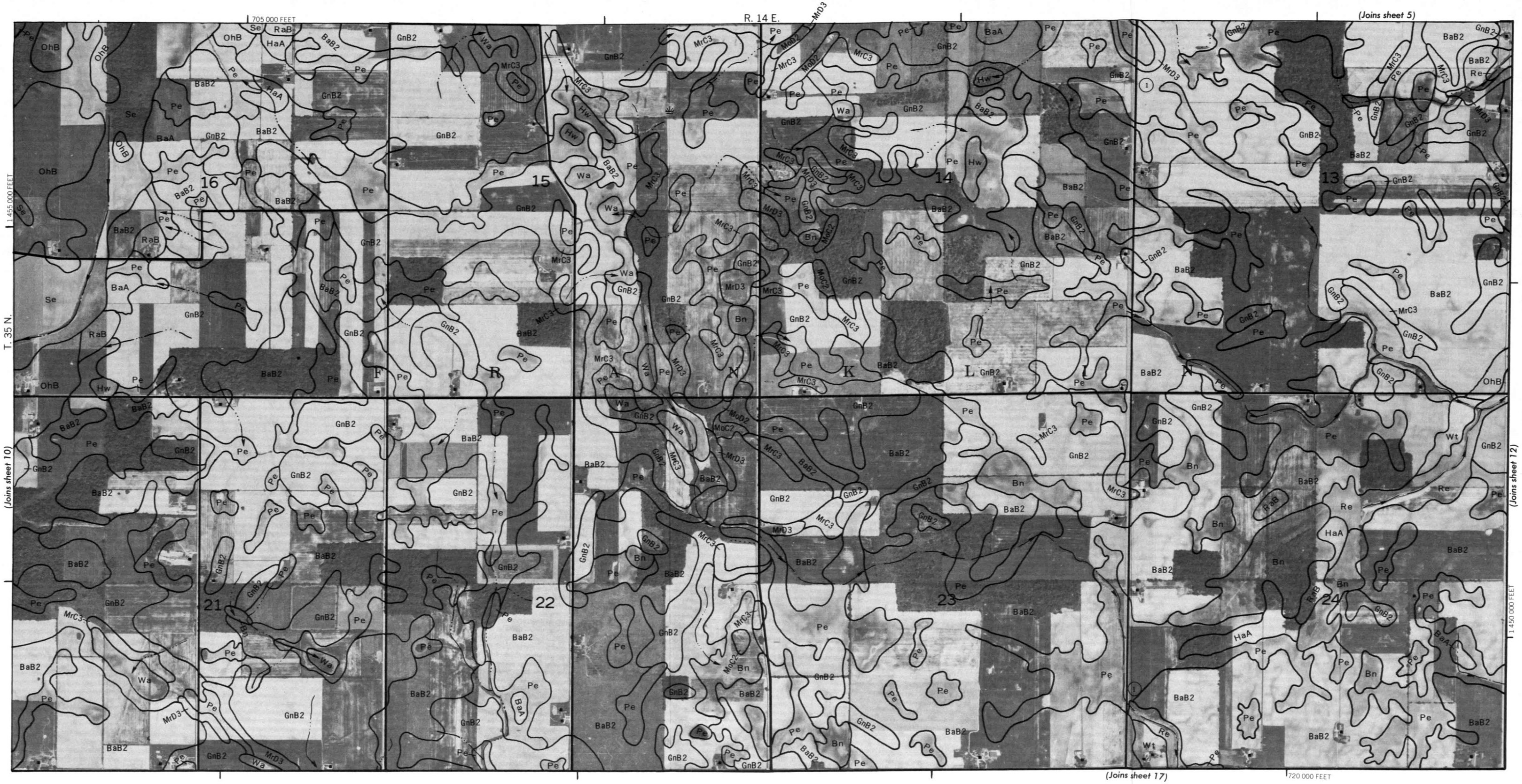


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 10

11

N



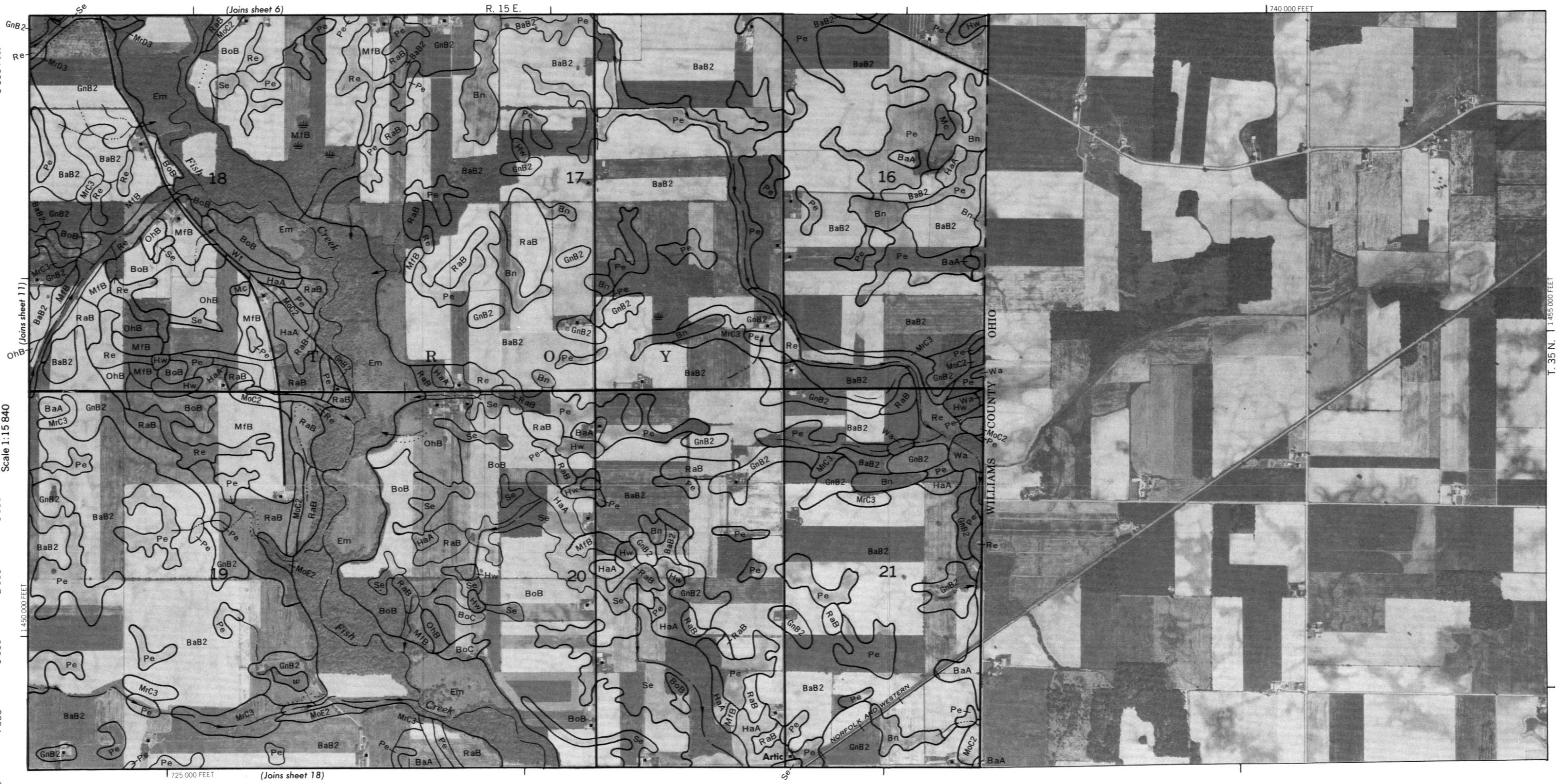
1 Mile
5 000 Feet
Scale 1:15 840

DEKALB COUNTY, INDIANA NO. 11

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

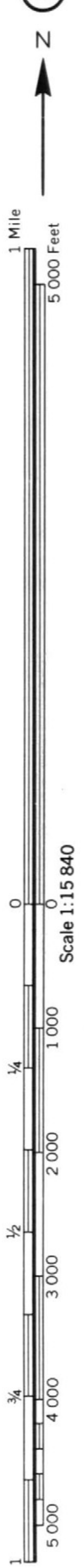
N

1 Mile
5 000 Feet
Scale 1:15 840



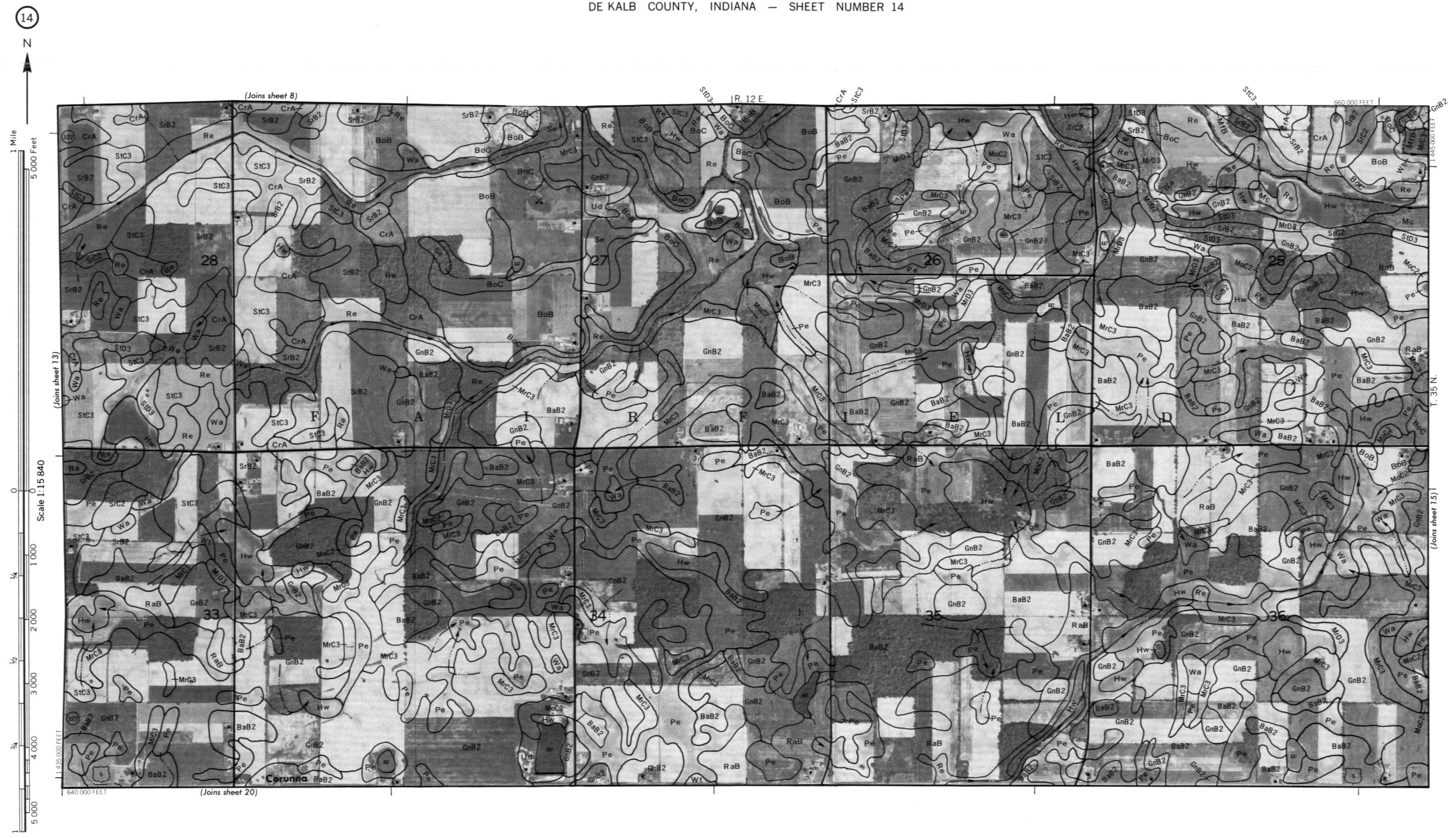
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

13

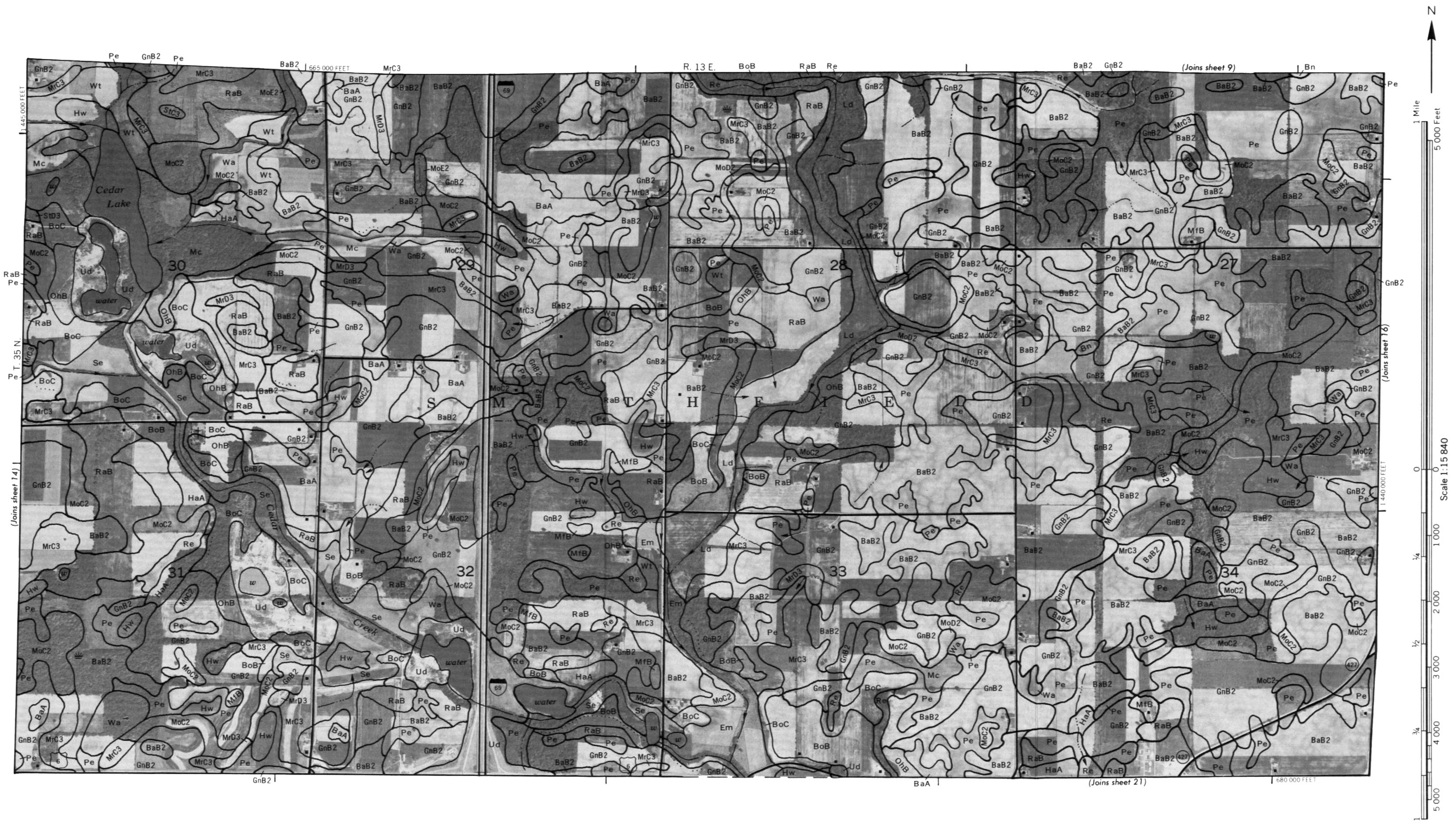


DEKALB COUNTY, INDIANA NO. 13

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



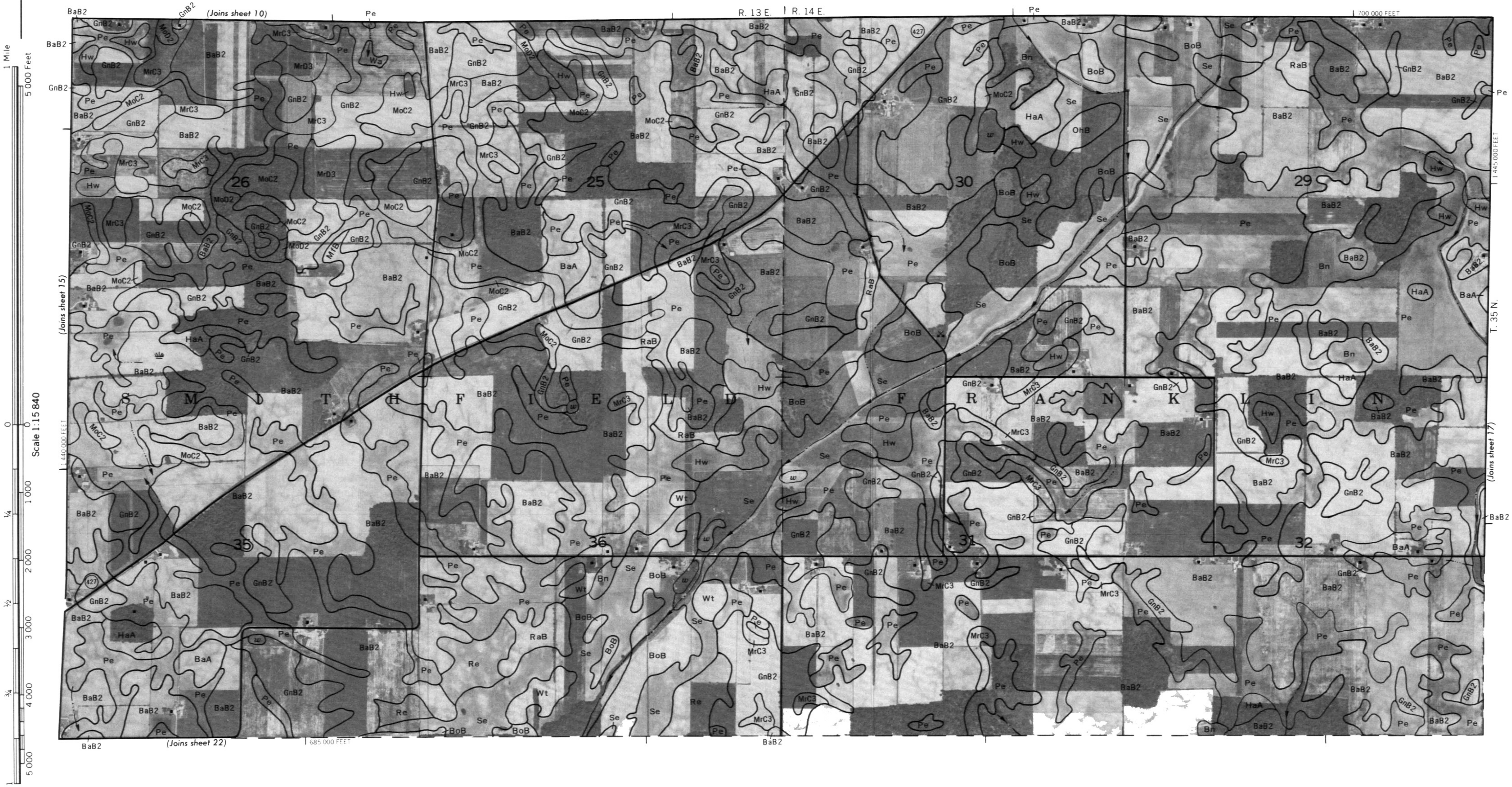
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



DEKALB COUNTY, INDIANA NO. 15

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

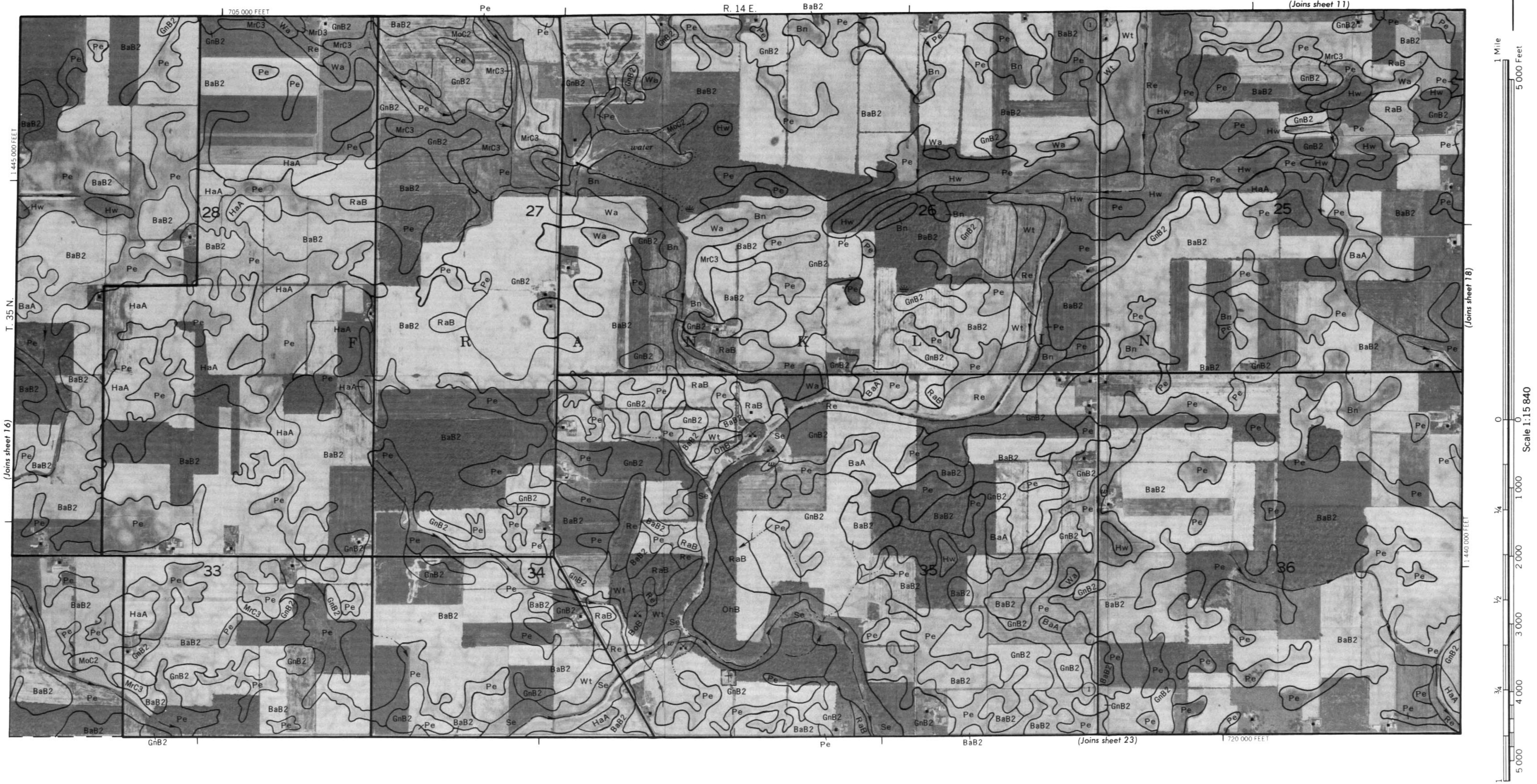
DE KALB COUNTY, INDIANA — SHEET NUMBER 16



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 16

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



DE KALB COUNTY, INDIANA — SHEET NUMBER 18

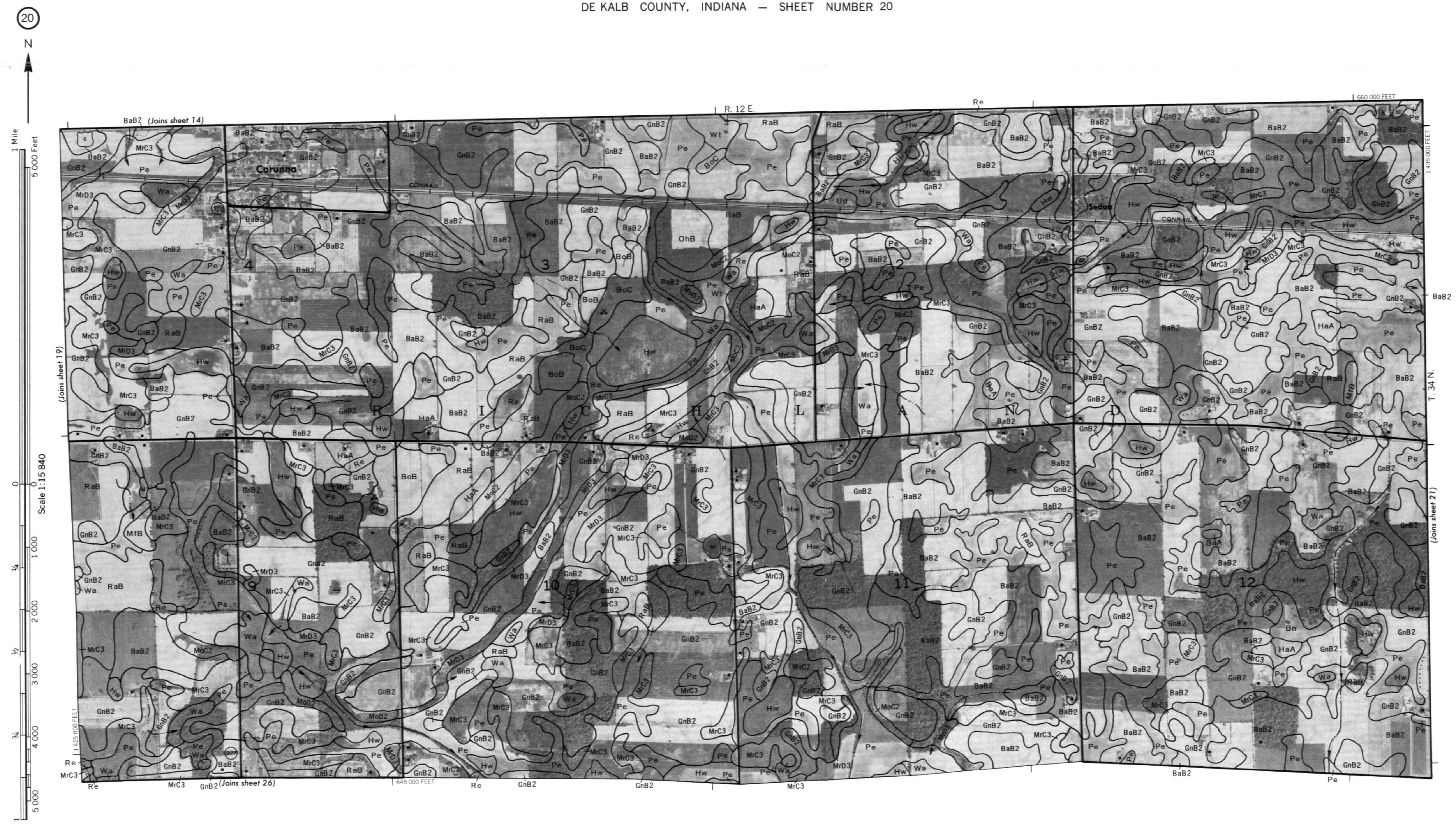
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 18

DEKALB COUNTY, INDIANA NO. 19

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 20



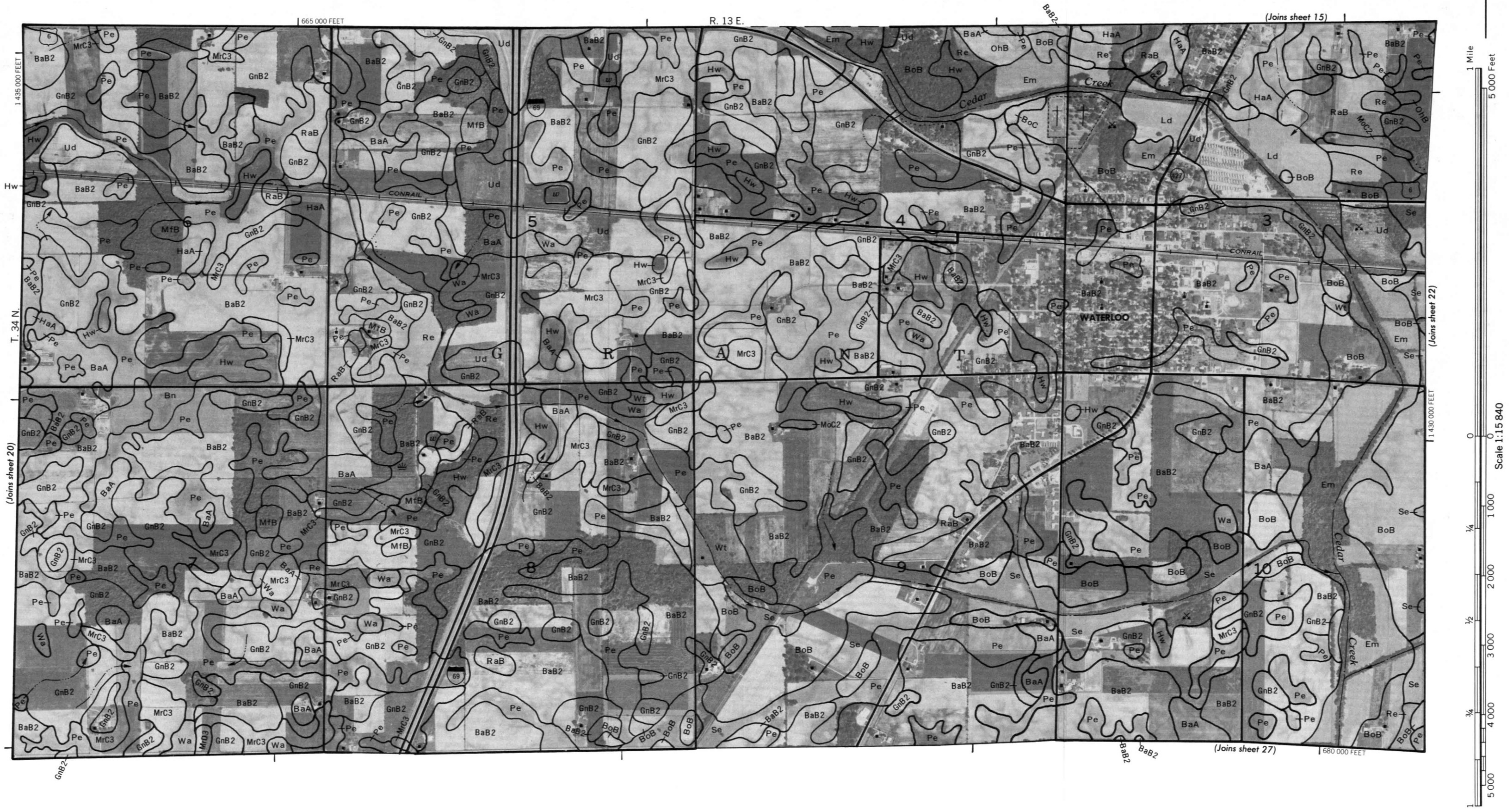
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 20

21

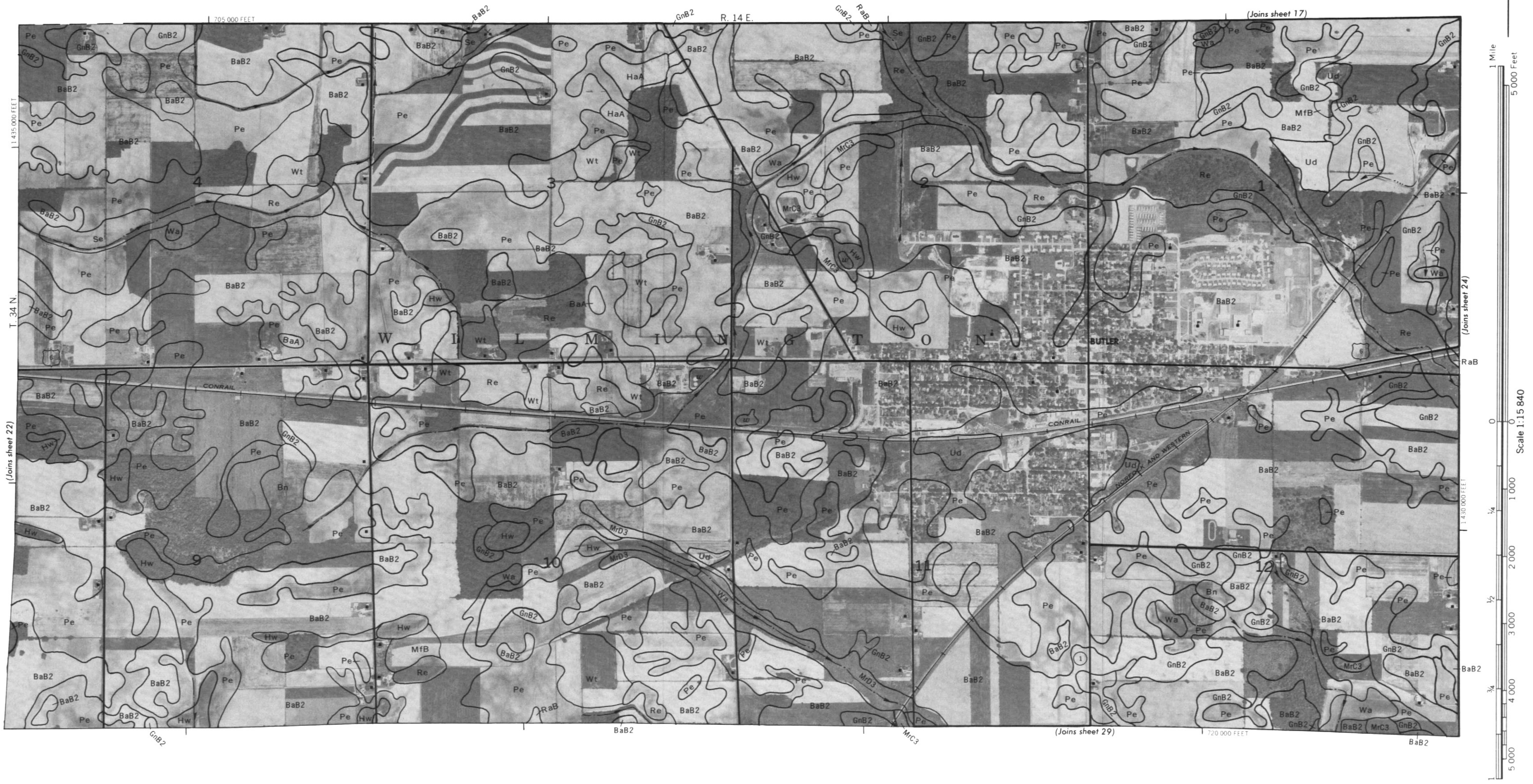
DEKALB COUNTY, INDIANA NO. 21

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

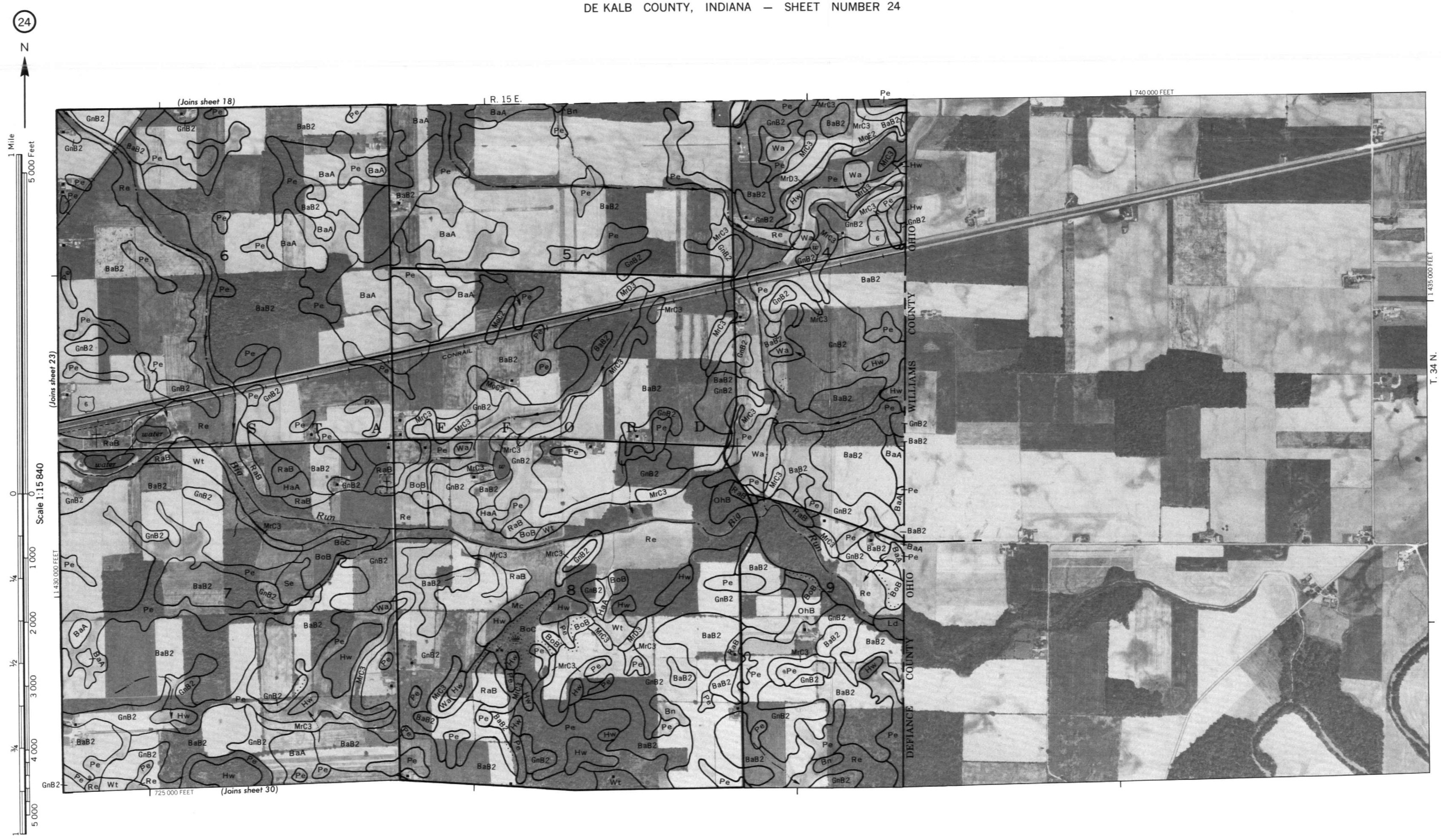
DEKALB COUNTY, INDIANA NO. 22



DeKALB COUNTY, INDIANA NO. 23

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 24

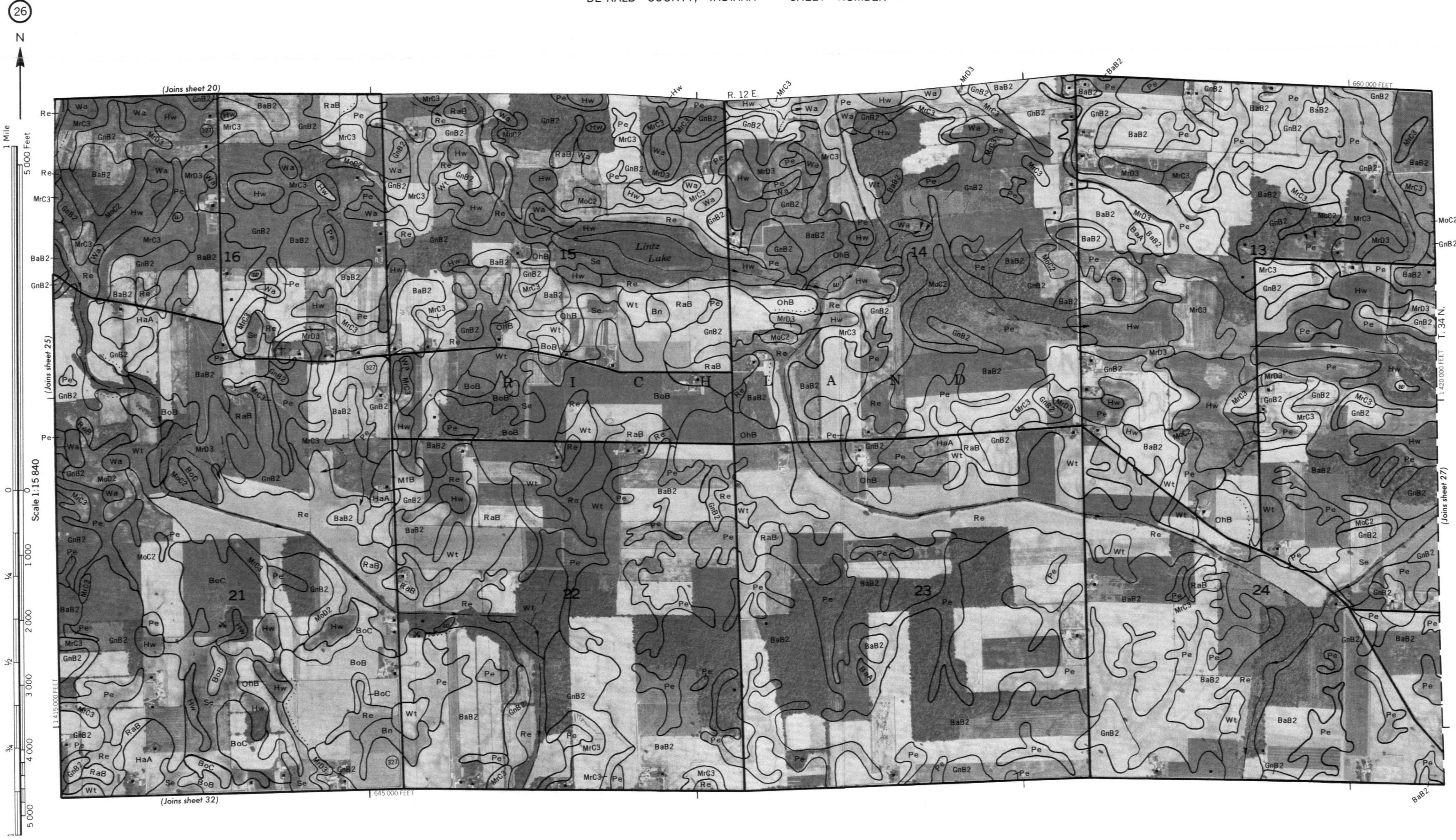


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 24

DEKALB COUNTY, INDIANA NO. 25

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

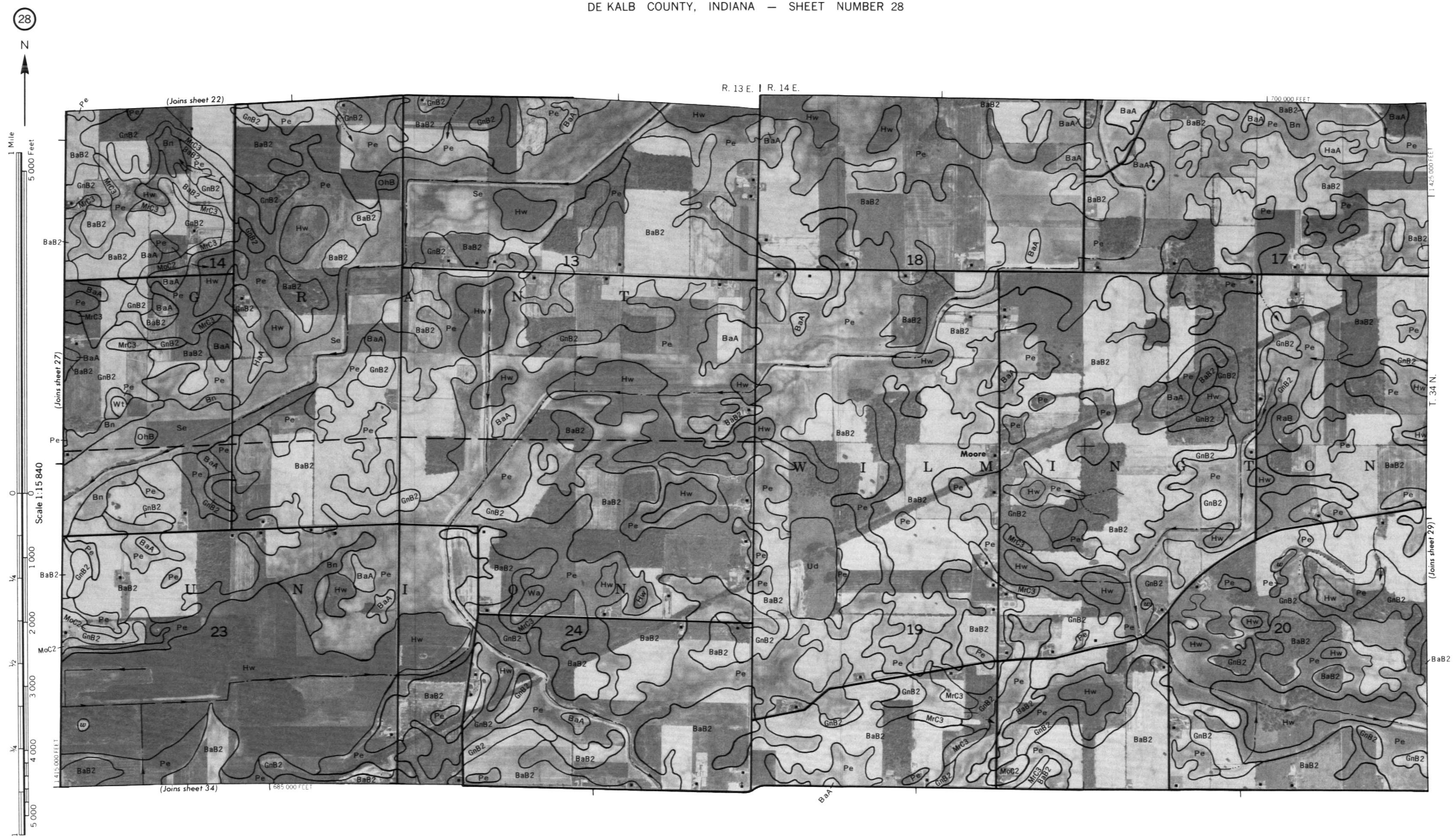


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 26

DEKALB COUNTY, INDIANA NO. 27

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

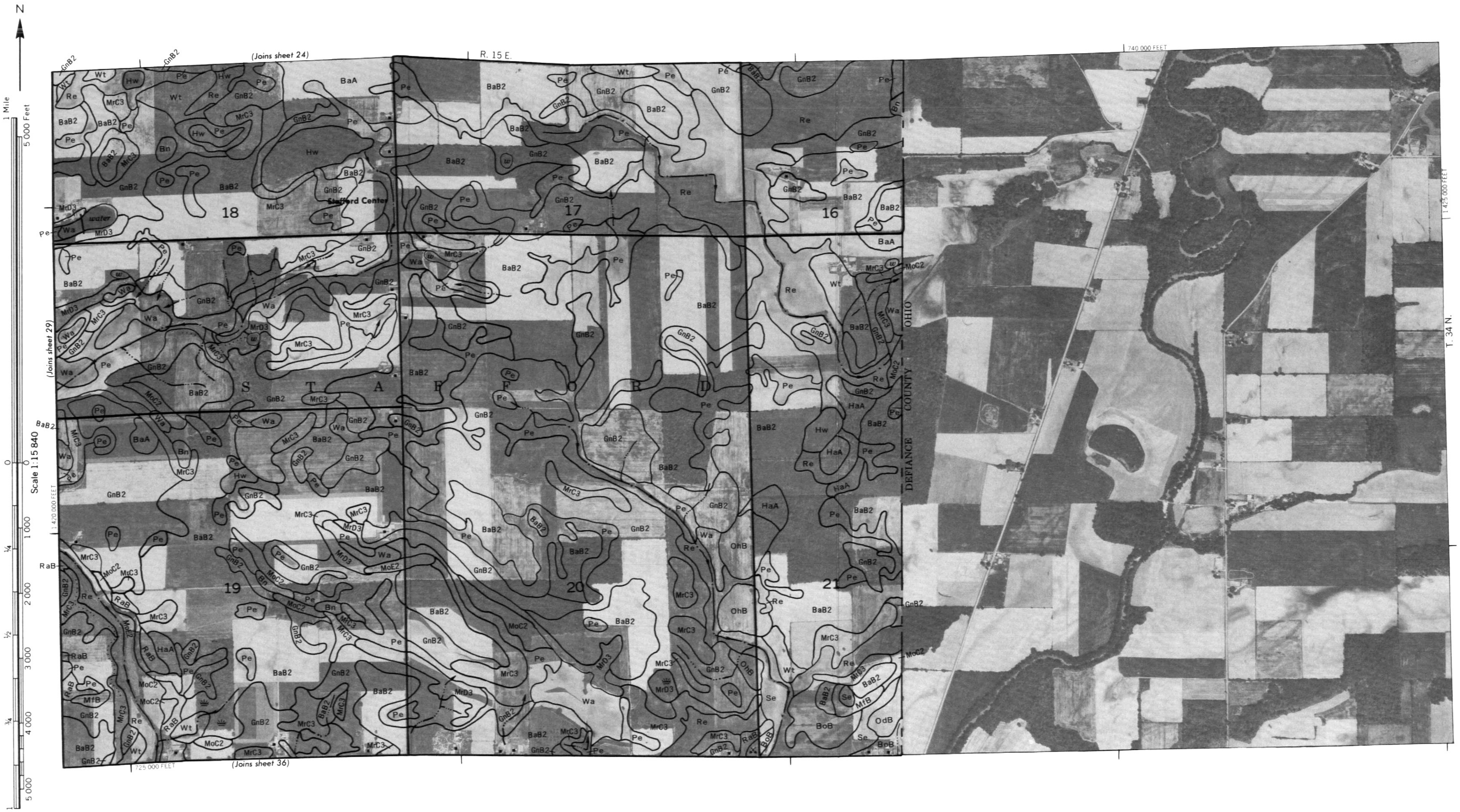


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 28

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 30

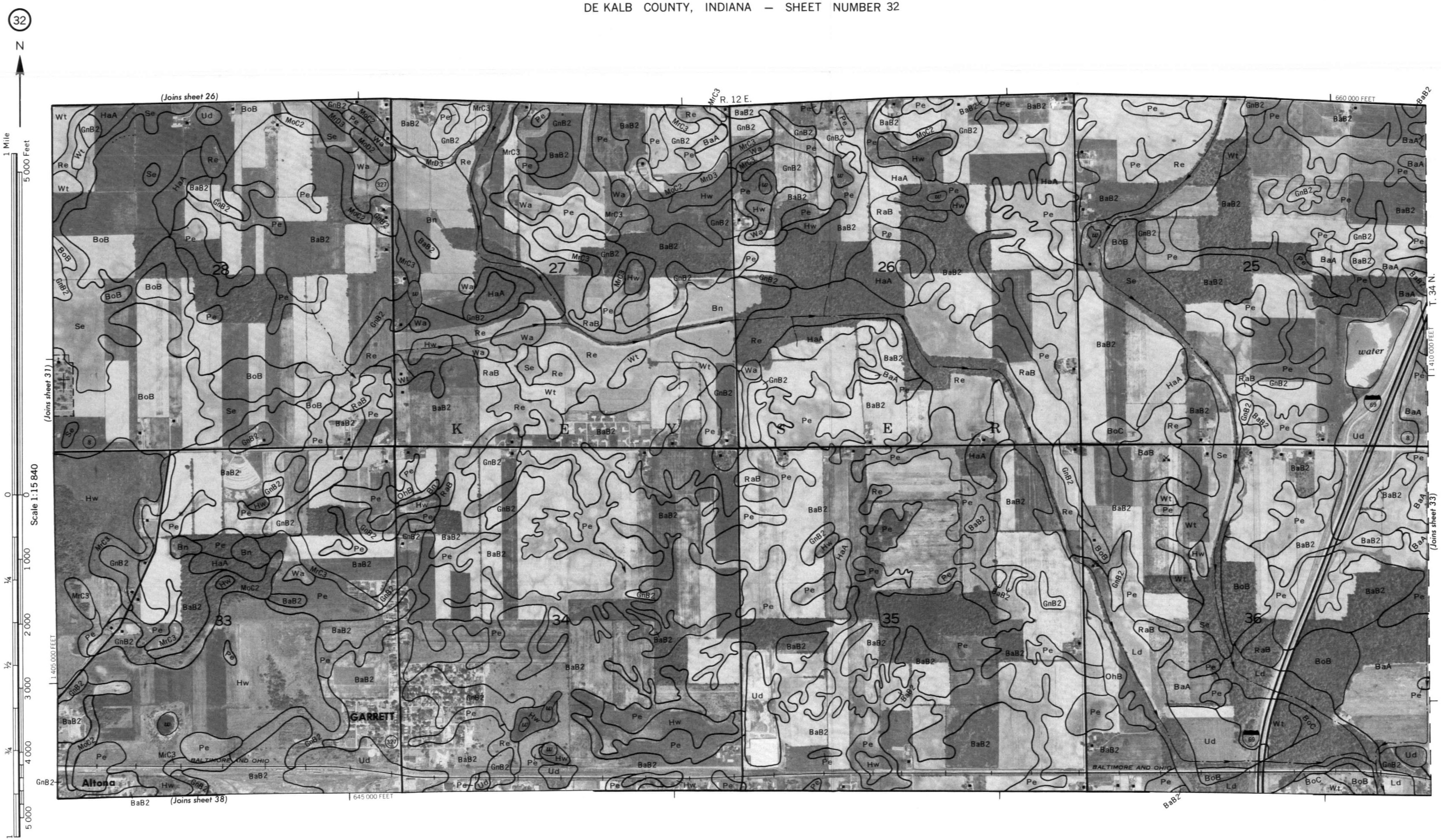


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 30

DEKALB COUNTY, INDIANA NO. 31

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

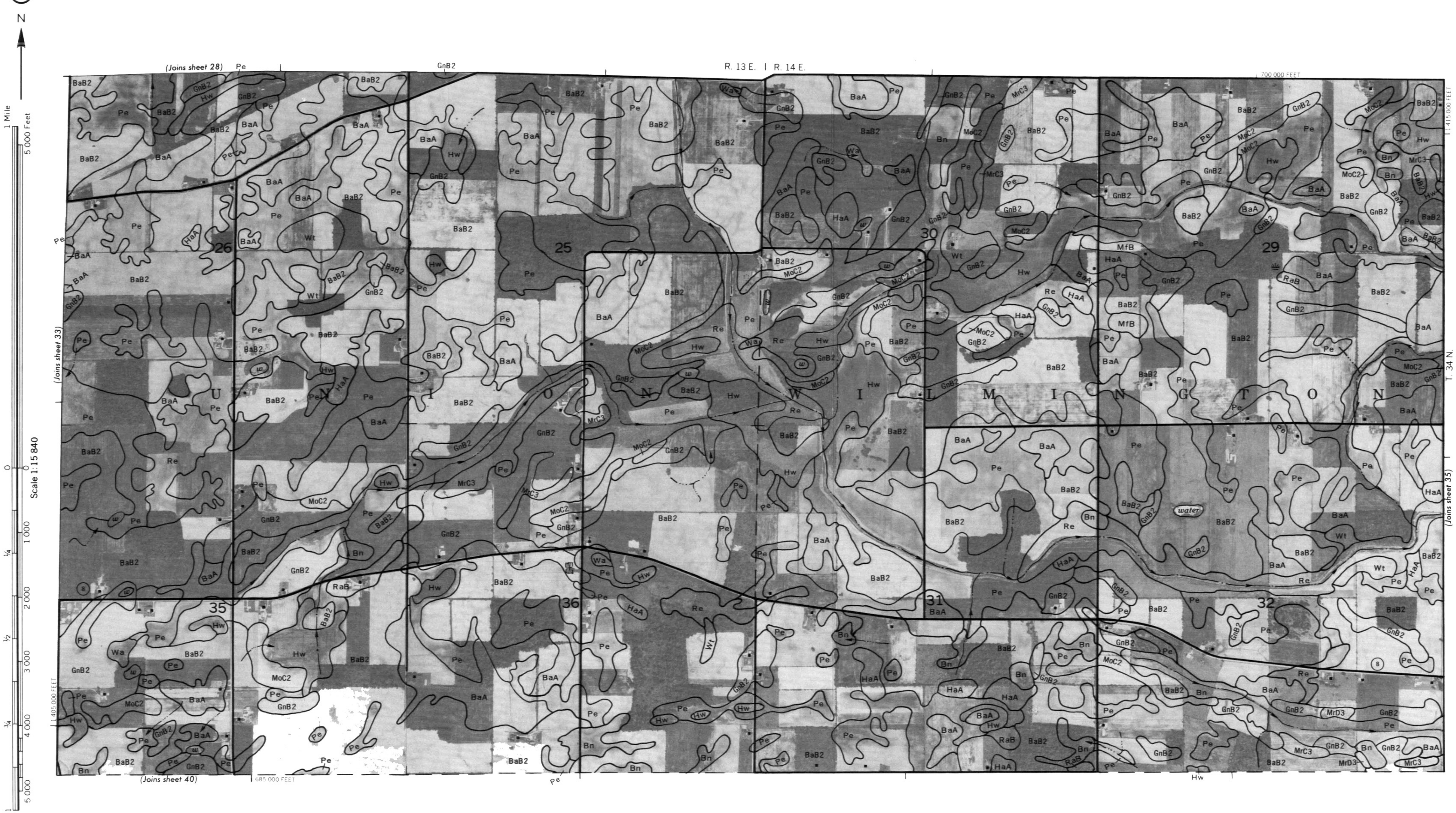


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 33

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 34



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

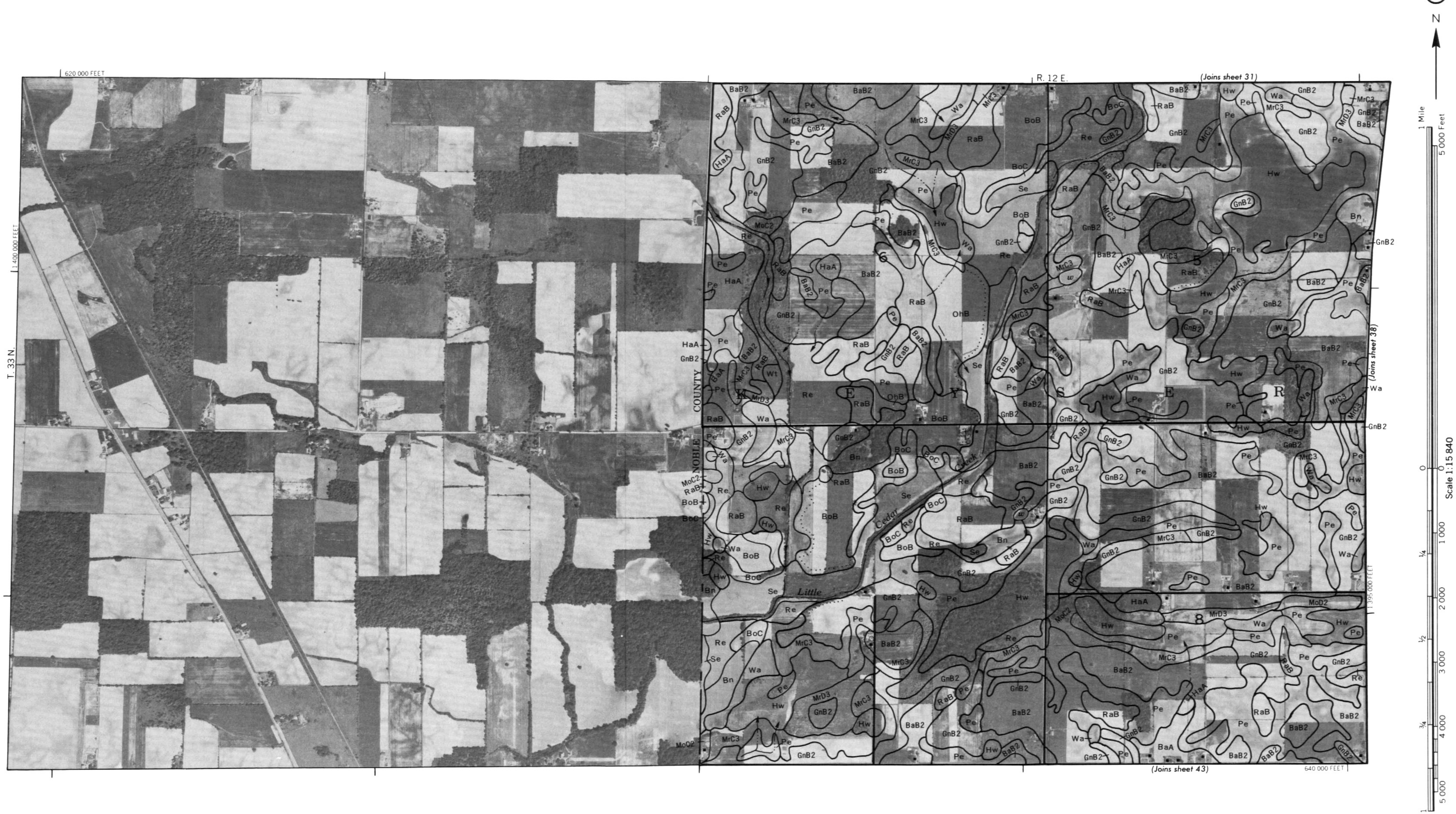
DEKALB COUNTY, INDIANA NO. 34

DEKALB COUNTY, INDIANA NO. 35

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

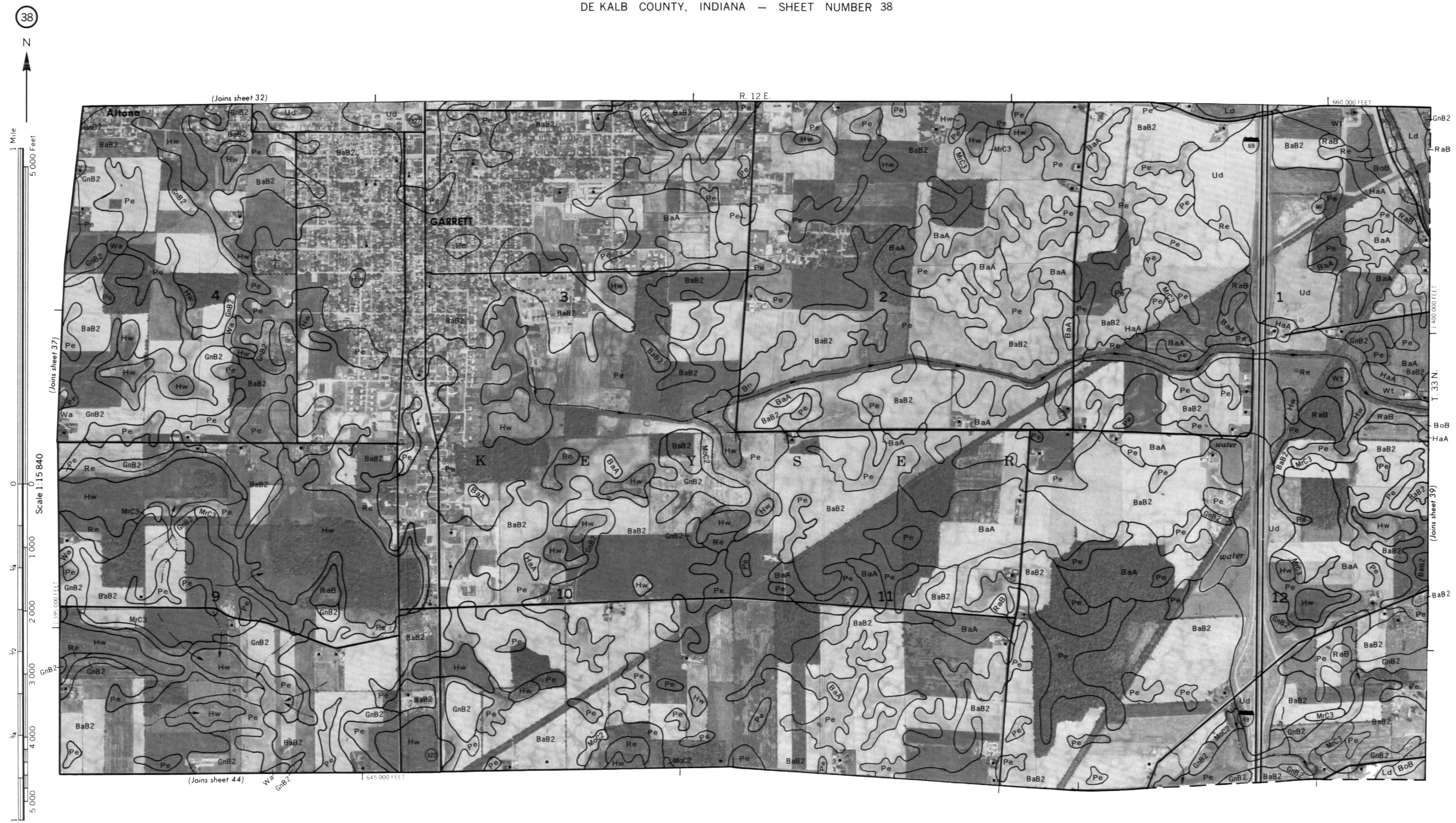
DE KALB COUNTY, INDIANA — SHEET NUMBER 36

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



DEKALB COUNTY, INDIANA NO. 37

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

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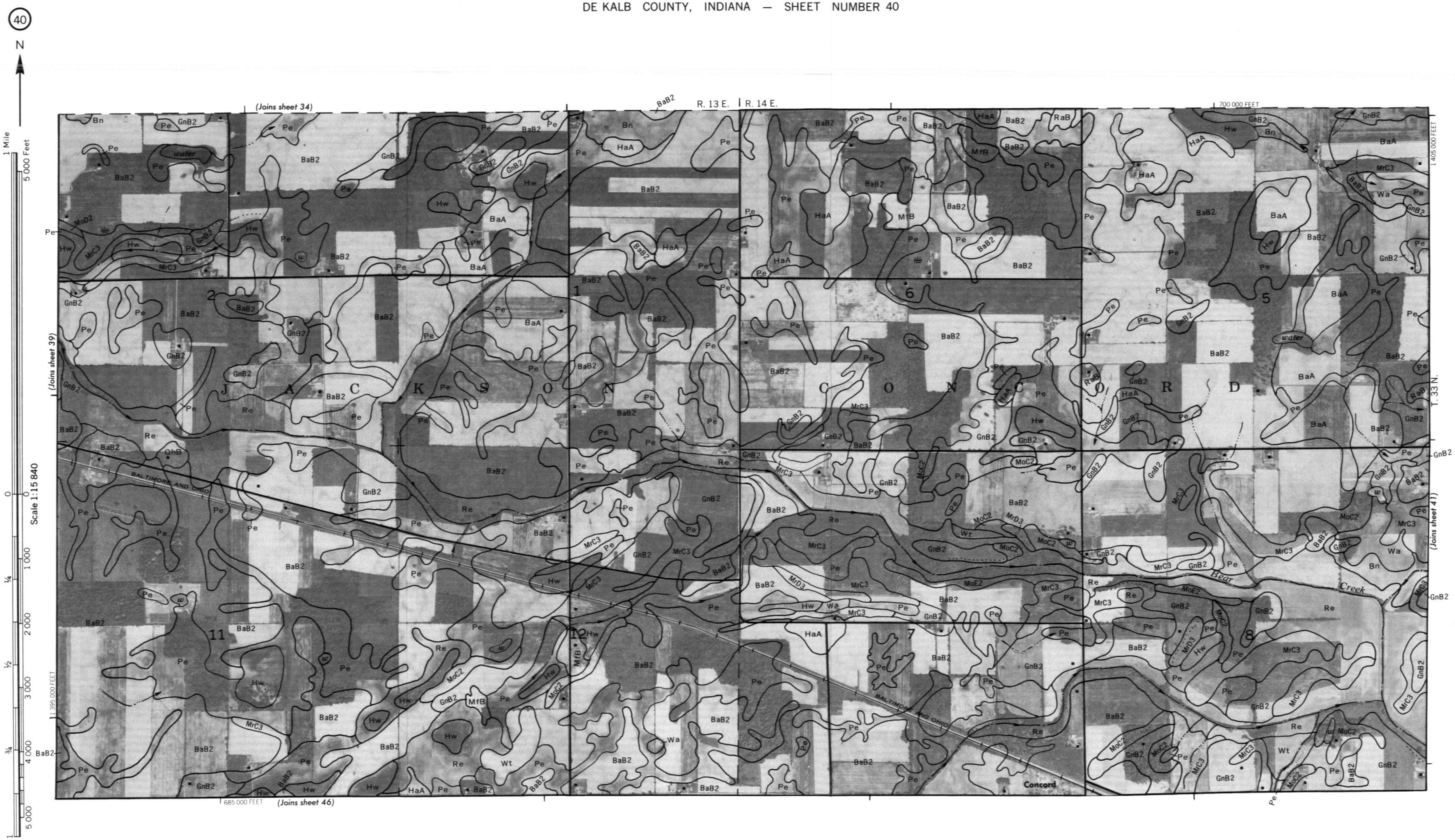
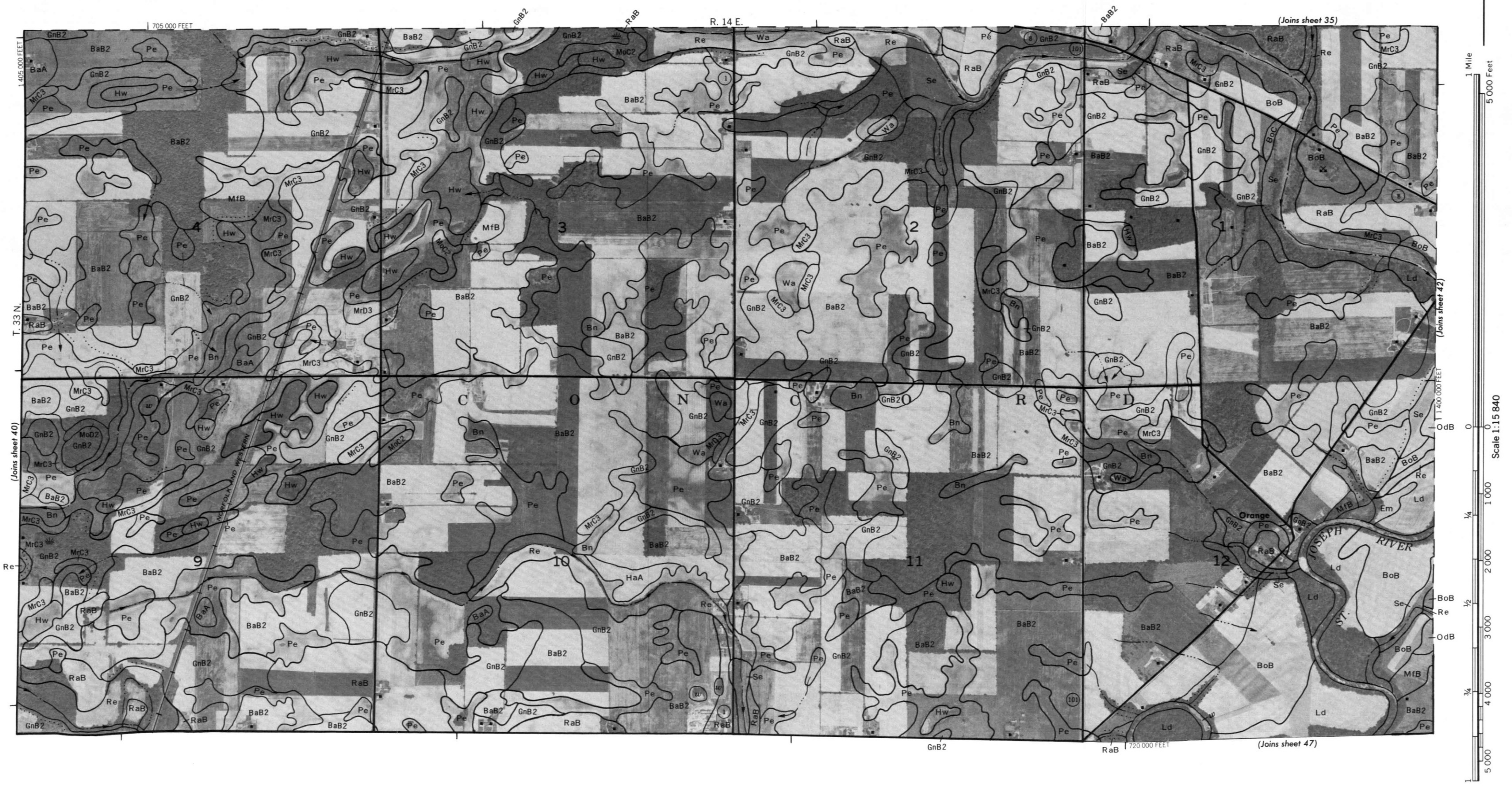
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

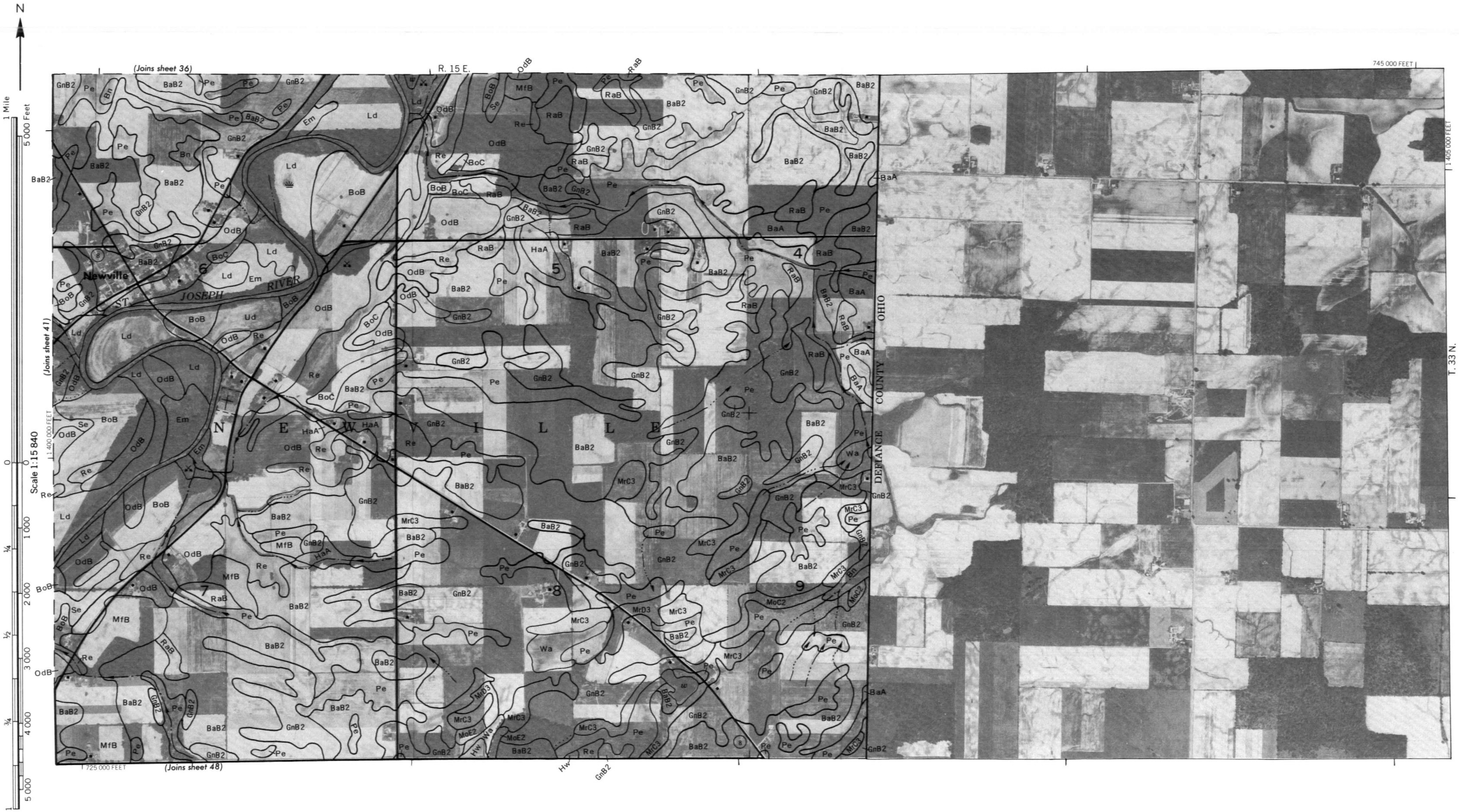


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 40



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 42

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

44

N

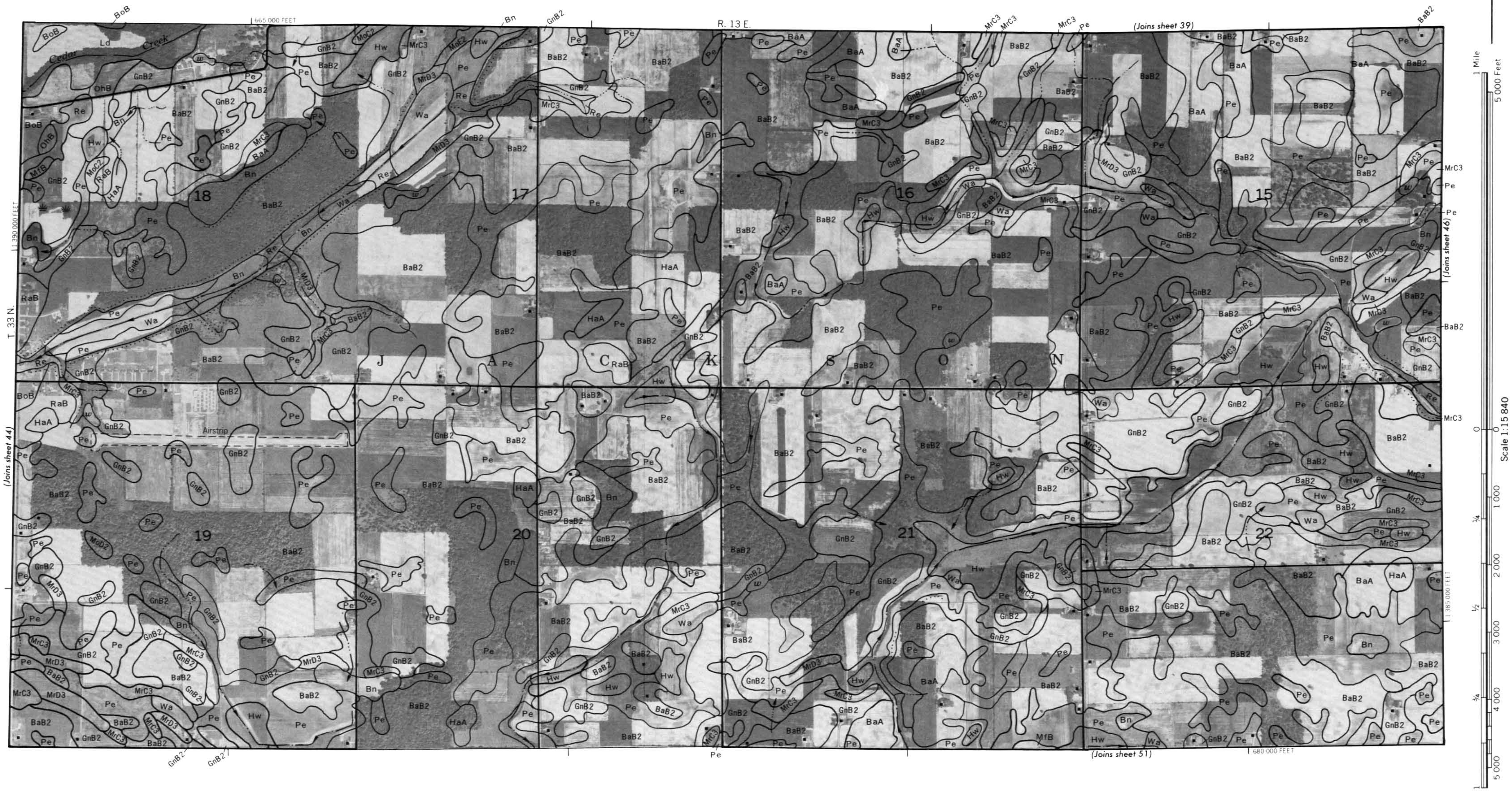
1 Mile
5 000 Feet
Scale 1:15 840
0 1 000 2 000 3 000 4 000 5 000
0 1/4 1/2 3/4 1

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 44

DEKALB COUNTY, INDIANA NO. 45

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

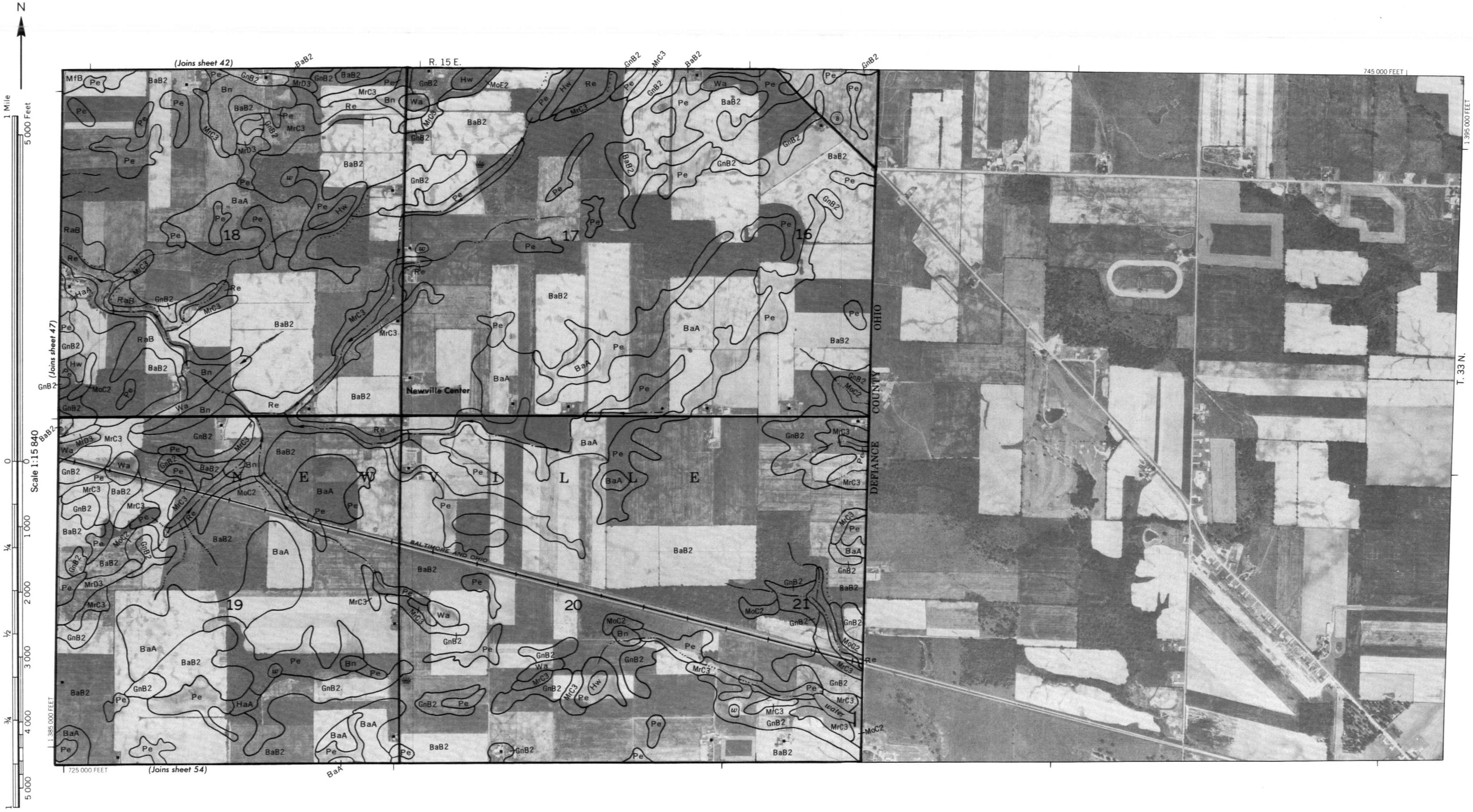



46
N
(Joins sheet 40)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 52)
R. 13 E.
R. 14 E.
T. 33 N.
Concord
BALTIMORE AND OHIO
NORFOLK AND WESTERN
JACKSON
CONCORD
SPENCER
14
13
18
17
23
24
19
20
water
700 000 FEET
685 000 FEET
1 390 000 FEET
1 385 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
DEKALB COUNTY, INDIANA NO. 46

DEKALB COUNTY, INDIANA NO. 47

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 48



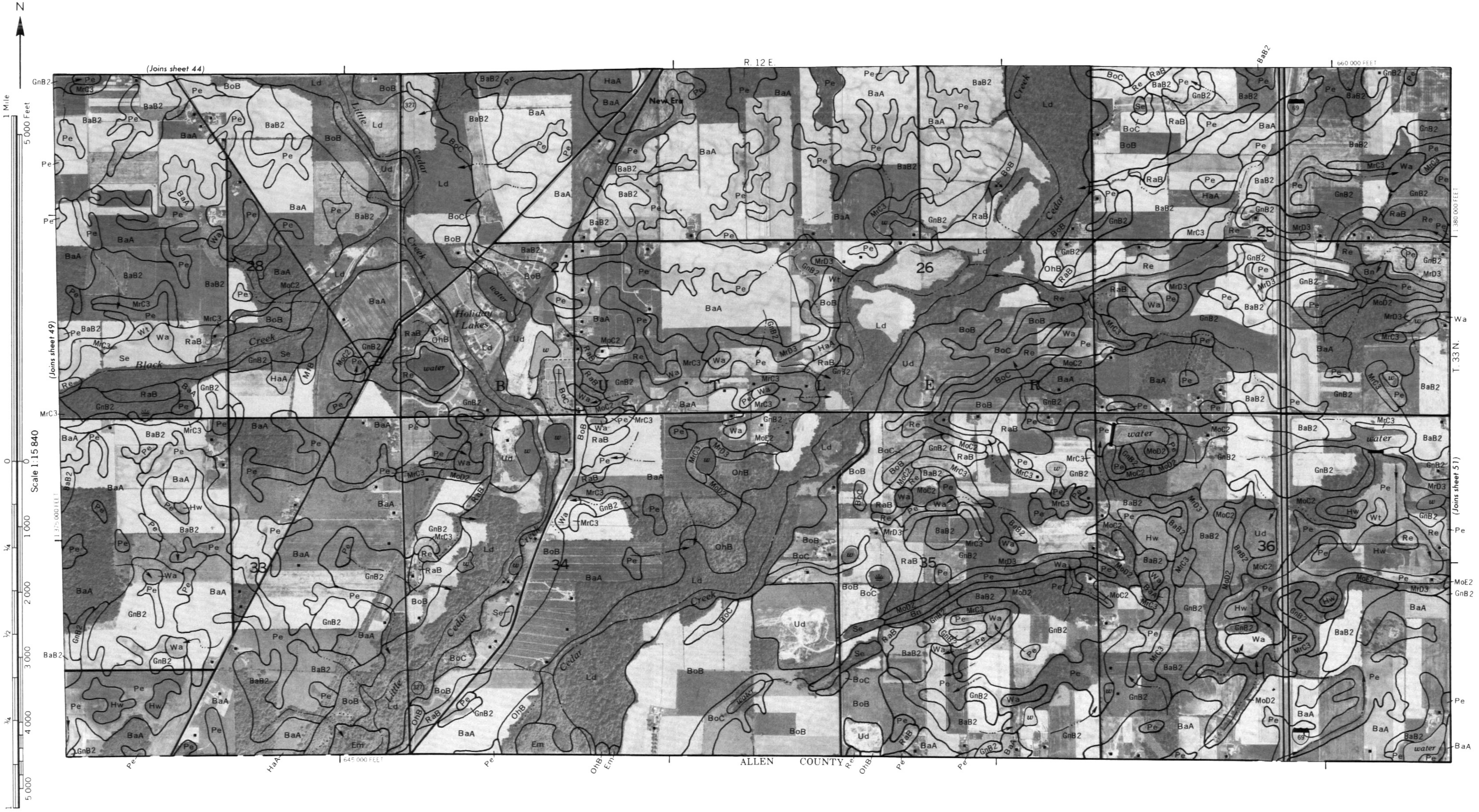
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 48

DEKALB COUNTY, INDIANA NO 49

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 50

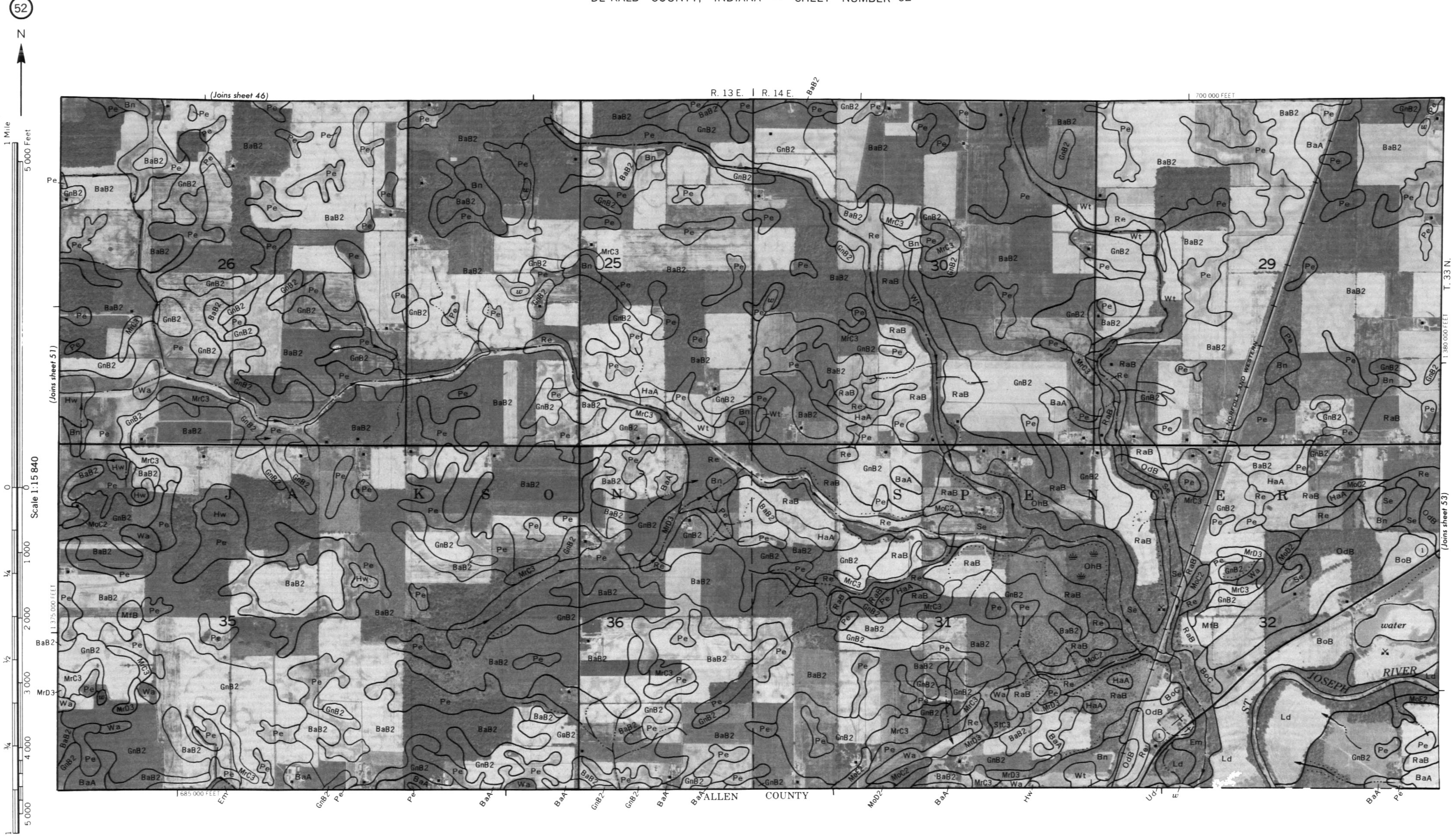


This map is compiled on 1971 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 51

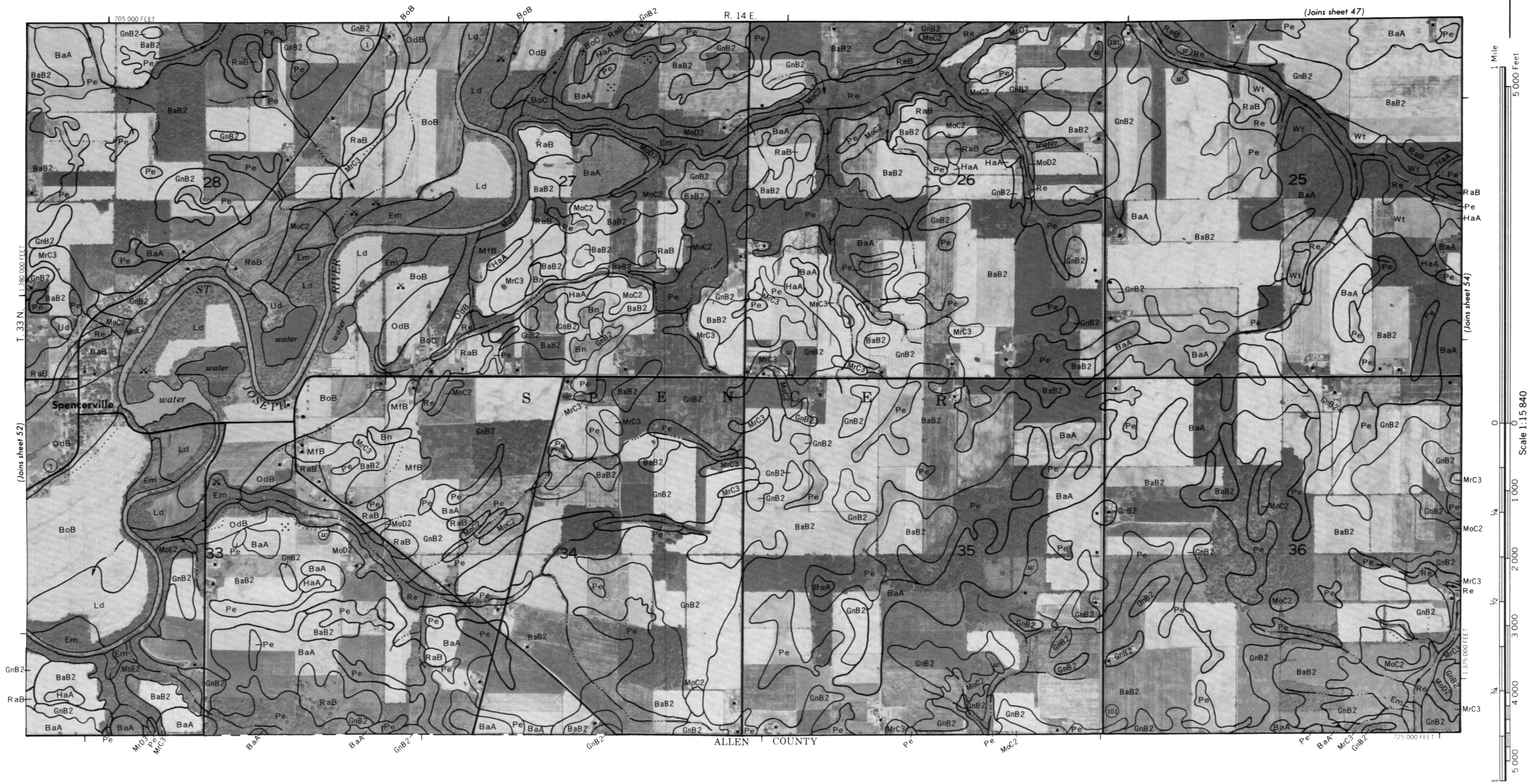
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DE KALB COUNTY, INDIANA — SHEET NUMBER 52



This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DEKALB COUNTY, INDIANA NO. 52



DEKALB COUNTY, INDIANA NO. 53

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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DEKALB COUNTY, INDIANA NO. 54